KEMA

REPORT OF PERFORMANCE 486-04

APPARATUS A three-phase common-operated outdoor SF_6 circuit-breaker, incorporating one interrupter per pole

TYPE 150-SFM-32B **SERIAL No.** 19979-C

170 kV – 3150 A – 25 kA – 50 Hz

CLIENT Crompton Greaves Limited,
Nashik, India

MANUFACTURER Crompton Greaves Limited,
Nashik, India

TESTED BY KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS 5th November 2004

TEST SPECIFICATION The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on 62271-100, and ENEL/TERNA Specification RQUPINT 001-R1, and CEI 17.1-1998-09 as reference standard.

This report consists of 38 sheets in total.

This report falls under the scope of the accreditation certificate L 020 of the Dutch Council for Accreditation.
See information sheet (page 1).

KEMA Nederland B.V.

P.P. Leufkens
Manager High-Power Laboratory

Arnhem, 17th March 2005

1 Certificate

A Certificate contains a record of a series of type tests carried out strictly in accordance with a recognized standard. The equipment tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by KEMA. The Certificate is applicable only to the equipment tested. KEMA is responsible for the validity and the contents of the Certificate.
The responsibility for conformity of any apparatus having the same designation as the one tested rests with the manufacturer. The Certificate contains the essential drawings and a description of the equipment tested.
Detailed rules are given in KEMA's Certification procedure.

2 Report of Performance

A Report of Performance contains a record of one or more tests which have been carried out according to the client's instructions. These tests are not necessarily in accordance with a recognized standard. The test results do not verify ratings of the test object.

KEMA issues three types of Reports of Performance:

2.1 *The tests have been carried out strictly in accordance with …. The apparatus has complied with the relevant requirements.*

This sentence will appear on the front page of a Report of Performance if the tests have been performed in accordance with a recognized standard, but the series of tests does not completely fulfil the requirements for a Certificate of Compliance (for example, if the number of test duties is not a complete series of type tests). The Report contains verified drawings and a description of the equipment tested. Detailed rules are given in KEMA's Certification procedure. The condition of the test object after the tests is assessed and recorded in the Report.

2.2 *The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on ....*

This sentence will appear on the front page of a Report of Performance if the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer. If the apparatus does not pass the tests such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on the client's request.

2.3 *The tests have been carried out according to the client's instructions.*

This sentence will appear on the front page of a Report of Performance if the tests, test procedure and/or test parameters are not in accordance with a recognized standard.

3 Standards

When reference is made to a standard, and the date of issue is not stated, this applies to the latest issue, including amendments which have been officially published prior to the date of the tests.

4 Official and uncontrolled test documents

The official test documents of KEMA High-Power Laboratory are issued in bound form. Uncontrolled copies may be provided as loose sheets or as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

5 Accuracy of measurement

In the table of test results the measured quantities are given in three digits. This method of presentation does not indicate an accuracy. The guaranteed uncertainty in the figures mentioned, taking into account the total measuring system, is less than 5%, unless mentioned otherwise.

6 Qualified by RvA (Dutch Council for Accreditation)

KEMA High-Power Laboratory and High-Voltage Laboratory have been entered in the RvA-register for laboratories under resp. Nrs. L 020 and L 218 for the testing services as defined in the Field of Accreditation.
The accreditation is carried out in accordance with ISO/IEC 17025.

TABLE OF CONTENTS:

RATINGS ASSIGNED BY THE MANUFACTURER

Voltage	170	kV
Normal current	3150	A
Number of poles	3	
Frequency	50	Hz
Operating sequence	O-0,3 s-CO-1 min-CO	
Short-time withstand current	25	kA
Peak withstand current	63	kA
Duration of short-circuit	3	s
Short-circuit making current	63	kA
Short-circuit breaking current	25	kA
DC time constant of rated short-circuit current	45	ms
DC component	46	%
First-pole-to-clear factor	1,5	
Pressure for interruption SF_6 at 20 °C	0,8	MPa
Pressure for insulation SF_6 at 20 °C	0,8	MPa
Line-charging breaking current	63	A
Cable-charging breaking current	160	A
Capacitor bank breaking current	400	A
Supply voltage of closing and opening devices	110	Vd.c.

Breaker is only intended for use in earthed neutral systems.

DESCRIPTION OF APPARATUS TESTED

A three-phase common-operated outdoor SF_6 circuit-breaker, incorporating one interrupter per pole

Minimum pressure for interruption at 20 °C	0,7	MPa
Maximum pressure for interruption at 20 °C	0,8	MPa

Mechanism:

Stored energy closing (springs, charged by motor).
Stored energy opening (springs, charged at closing).

Supply voltage closing coil	110	Vd.c.
Supply voltage opening coil	110	Vd.c.
Supply voltage motor	110	Vd.c.

TRAVEL RECORDER

Travel recorder non-linear with contact travel.

DRAWINGS

The manufacturer has guaranteed that the equipment submitted for tests has been manufactured in accordance with the drawings mentioned below.
KEMA has verified that these drawings adequately represent the equipment tested.
The following drawings has been included in this report.
3 94 4576 Rev. 0
3 94 1309 Rev. 0
3 94 4602 Rev. 0
3 94 4416 Rev. 0
2 94 0583 Rev. 4
List of Guaranteed Technical Particulars
Drawings list type B
3 94 4545 Rev. 0
1 94 4535 Rev. 0

The following drawings are only listed for reference and are kept in KEMA's files.
KEMA has also verified these drawings.
2 94 4417 Rev. 0
2 94 4499 Rev. 0
3 94 4483 Rev. 0
3 94 4500 Rev. 0
3 94 4501 Rev. 0
3 94 4171 Rev. 0
3 94 0630 Rev. 0
3 94 4473 Rev. 0
HL 69774 Rev. 1
4 94 4176 Rev. 0
3 94 4177 Rev. 0
3 94 0631 Rev. 0
3 94 4346 Rev. 0
3 94 4428 Rev. 0
1 94 0583 Rev. 4
HW 52358 G12 Rev. 2
3 94 0416 Rev. 0
1 94 4535 Rev. 0
HK 88705 Rev. 3
HK 88094 Rev. 1
HK 88092 Rev. 1
HK 88090 Rev. 6
H2A 5316 Rev. 0
H2C 9027 Rev. 1
HL 58085 Rev. 1
HL 94233 Rev. 1
HK 88091 Rev. 0
HR 86364 Rev. 1
HP 97885 Rev. 3
HV 53930 Rev. 3
4 94 4045 Rev. 4
4 94 4005 Rev. 3
3 94 0484 Rev. 1
3 94 4457 Rev. 0
3 94 4458 Rev. 0
3 94 1093 Rev. 5
HJ 79291 Rev. 7
4 94 0011 Rev. 7
3 94 4636 Rev. 0
3 94 4658 Rev. 0
2 94 1310 Rev. 0

THE TESTS WERE WITNESSED BY

Name	Company
Shelar, P.P.	Crompton Greaves Limited, Nashik, India

THE TESTS WERE OBSERVED BY

Name	Company
Brienen, M.	KEMA, Arnhem, The Netherlands

PHASE INDICATIONS

If more than one phase is recorded on oscillogram, the phases are indicated by the digits 1, 2 and 3. These phases 1, 2 and 3 correspond to the phase values in the columns of the accompanying table, respectively from left to right.

EXPLANATION OF THE LETTER SYMBOLS AND ABBREVIATIONS ON THE OSCILLOGRAMS

pu	Per unit (the reference length of one unit is represented by the black bar on the oscillogram)
CS	Timing signal contact separation
ITOcl	Current closing coil test object
ITOop	Current opening coil test object
TR	Travel recorder

TEST NUMBERS

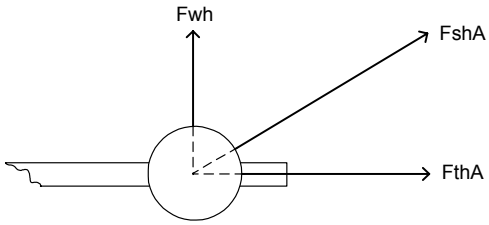
041105-5001
041105-5002
041105-5003
041105-5004

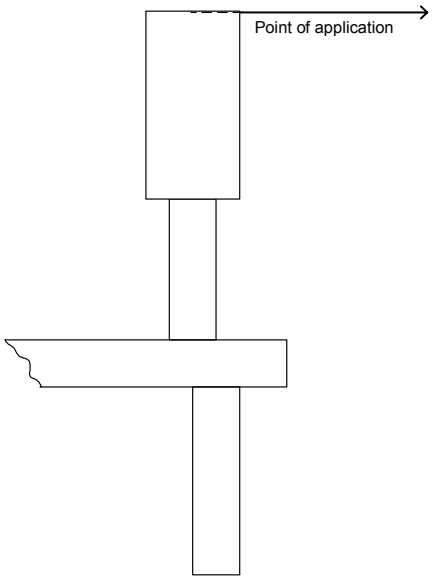
CONDITION BEFORE TESTS

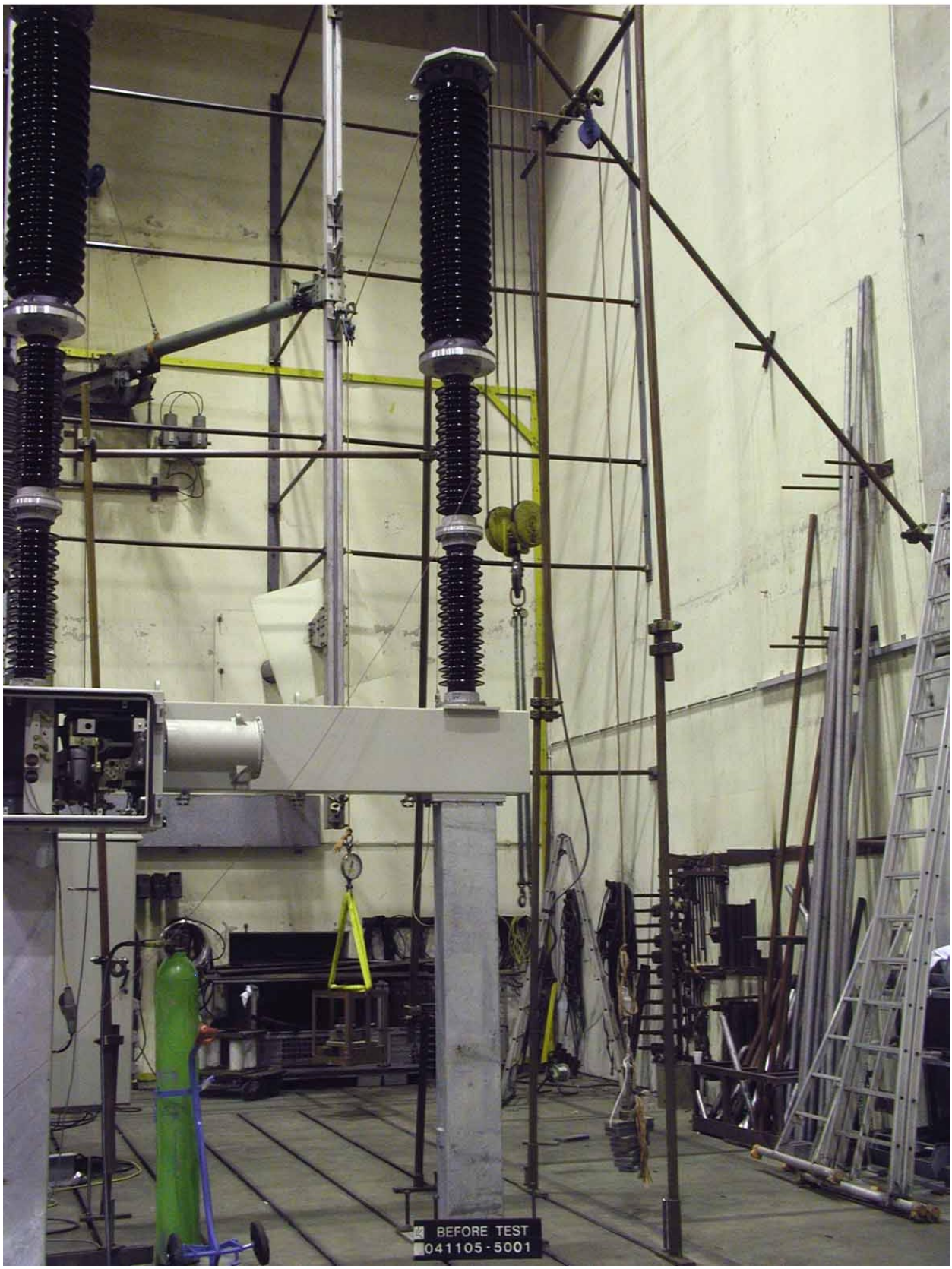
Breaker previously subjected to short-circuit tests and capacitive tests.

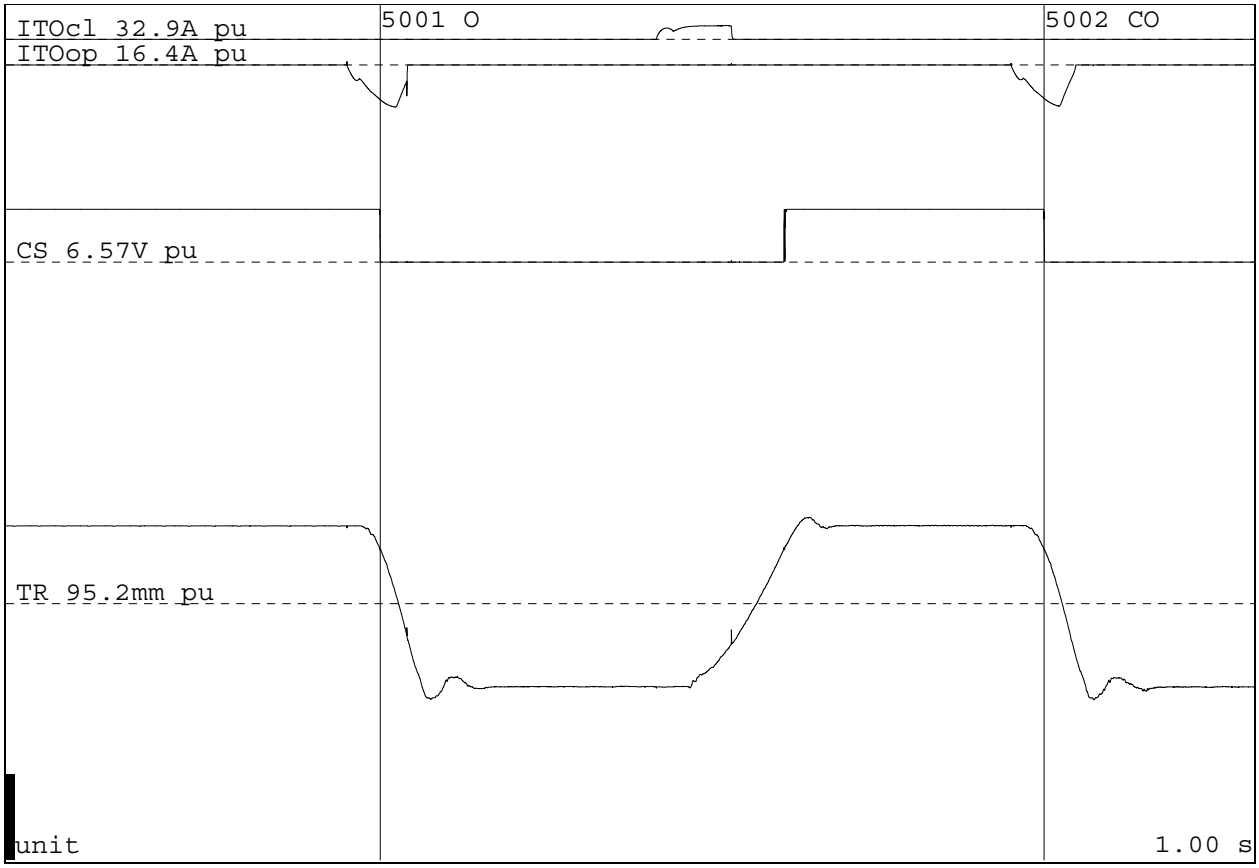
Tests 041105-5001 and 5002 : O – CO operation without terminal load forces.
Tests 041105-5003 and 5004 : O – CO operation with the following terminal load forces:
FthA = 1250 N
Fwh = 560 N
Point of application: top of the terminal

TEST ARRANGEMENT






BEFORE TEST
041105-5001

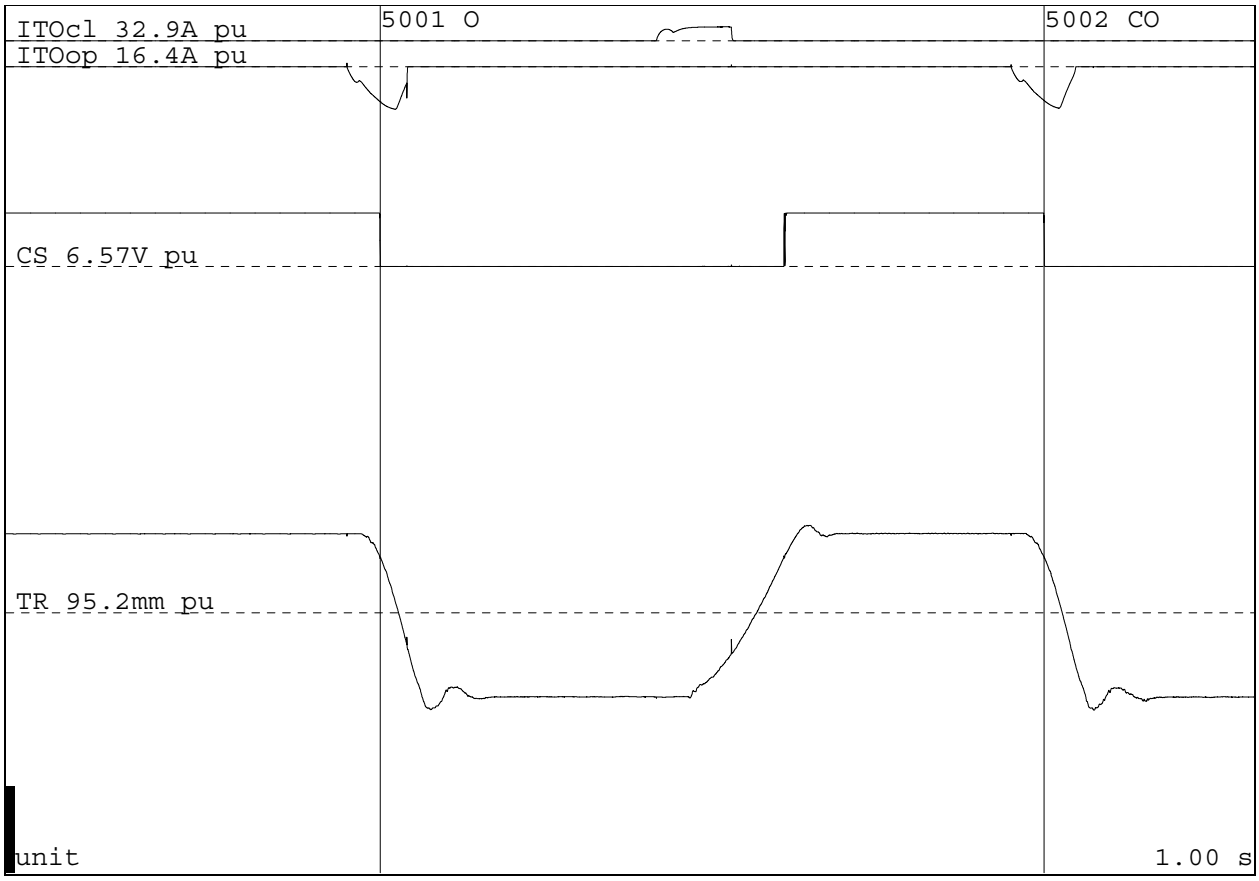


TEST NUMBER: 041105-5001

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,6

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

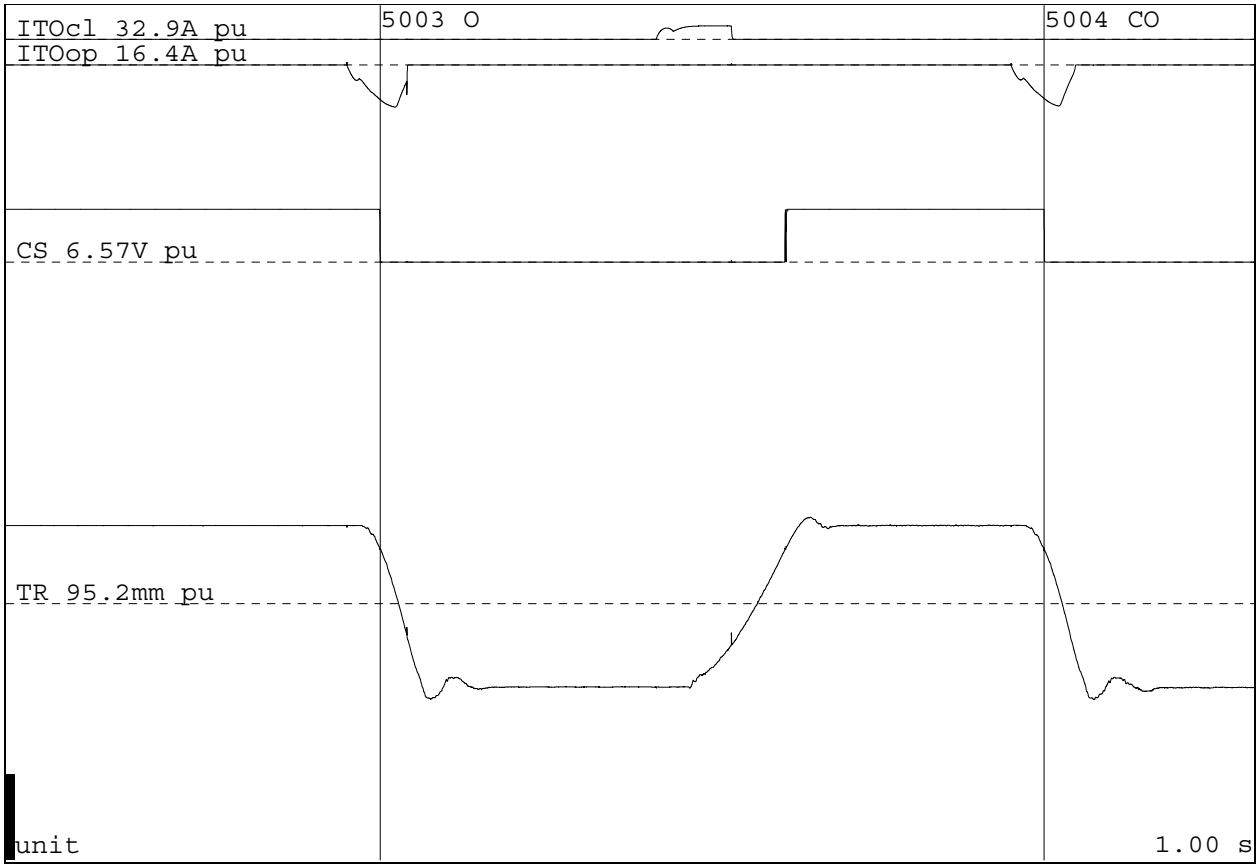


TEST NUMBER: 041105-5002

Time interval between operations	s	0,323
Operation		CO
Phase		**C**
Current closing coil	A	7,90
Closing time	ms	102
Current opening coil	A	-6,44
Opening time	ms	25,6

Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

Remarks: -

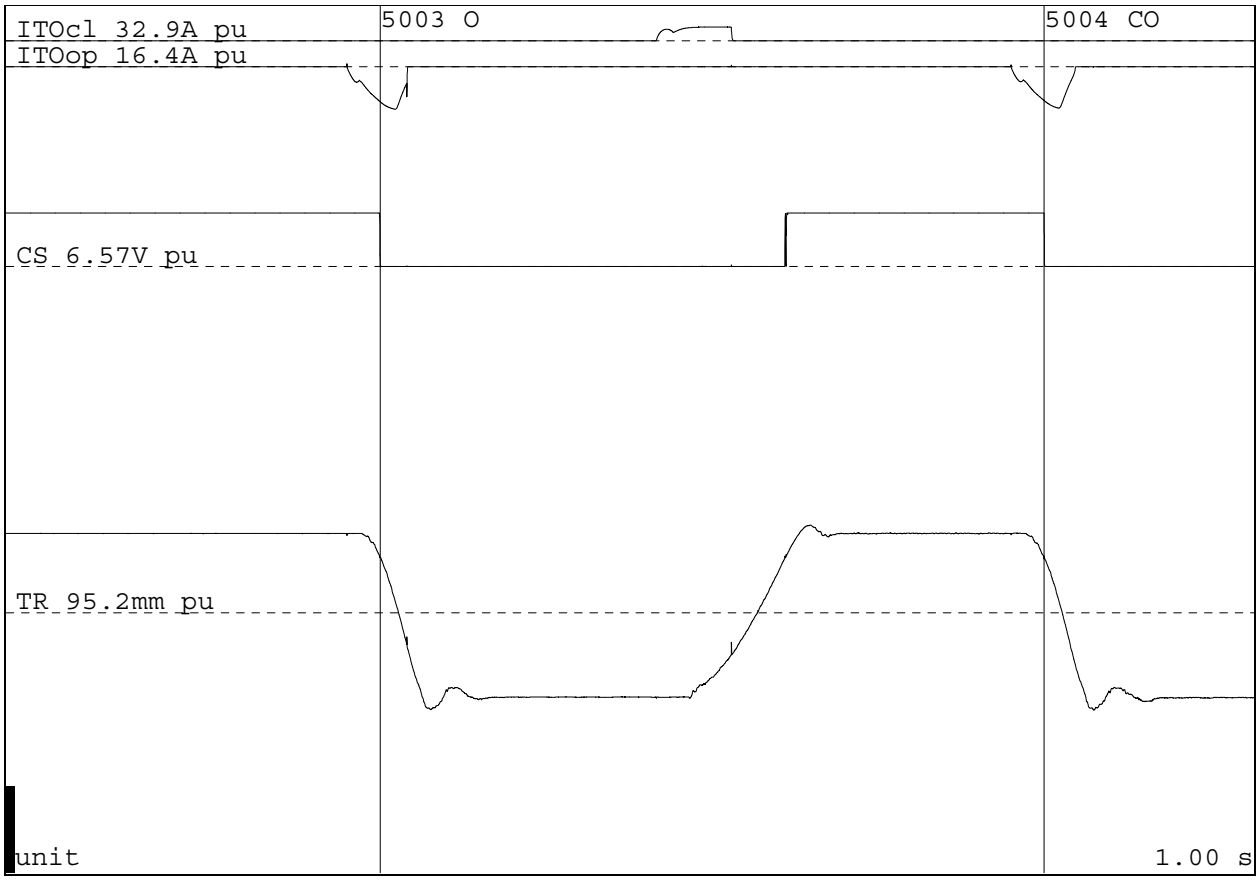


TEST NUMBER: 041105-5003

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,5

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

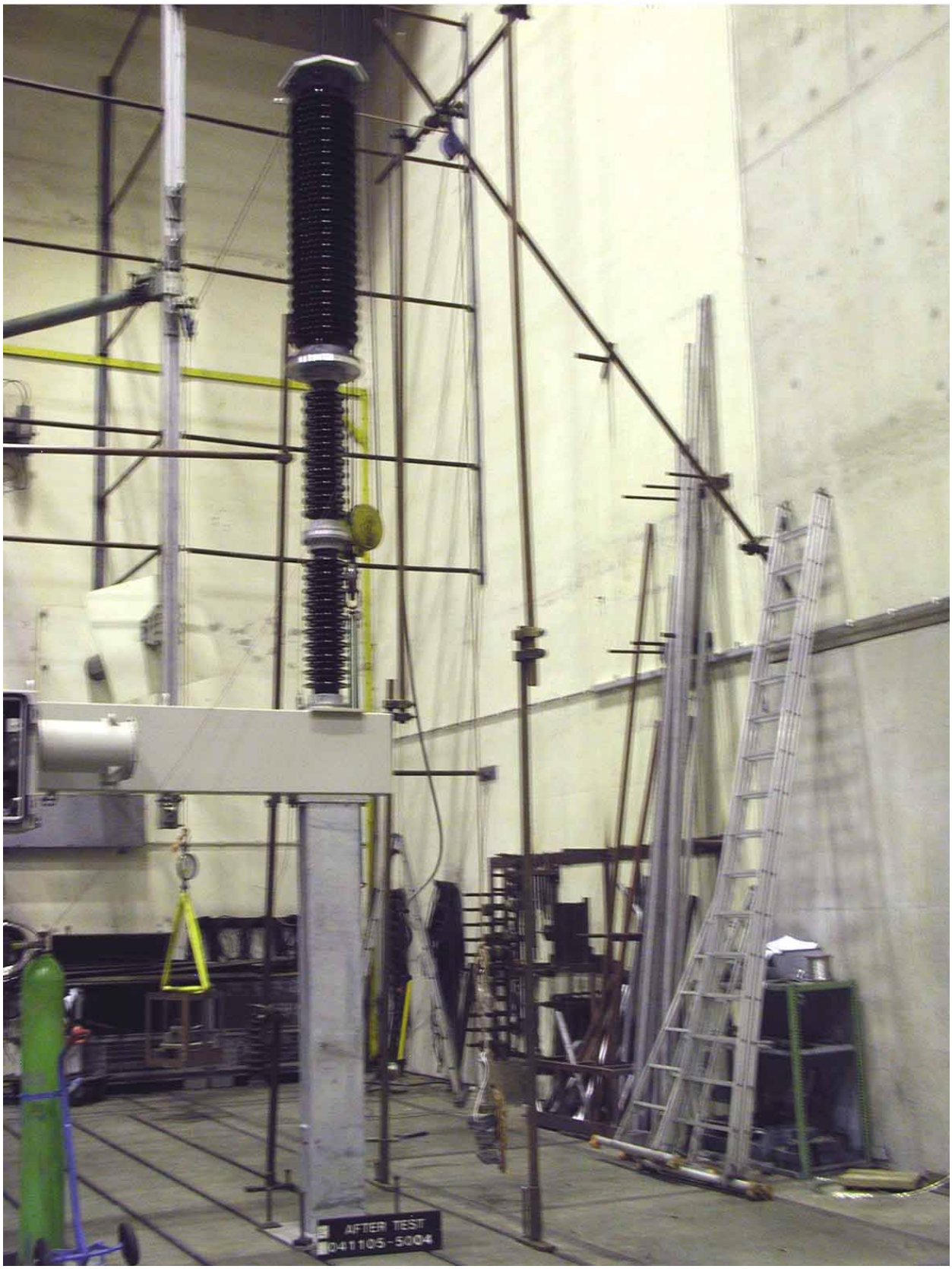


TEST NUMBER: 041105-5004

Time interval between operations	s	0,324
Operation		CO
Phase		**C**
Current closing coil	A	5,24
Closing time	ms	103
Current opening coil	A	7,90
Opening time	ms	25,8

Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

Remarks: -


AFTER TEST
041105-5004

TEST NUMBERS

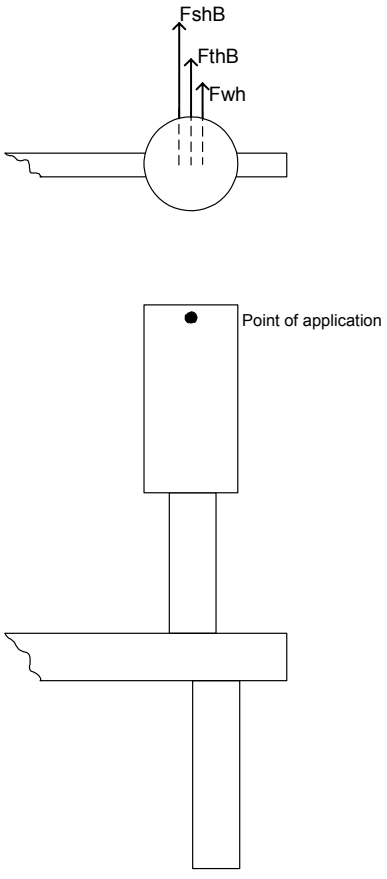
041105-5005
041105-5006
041105-5007
041105-5008

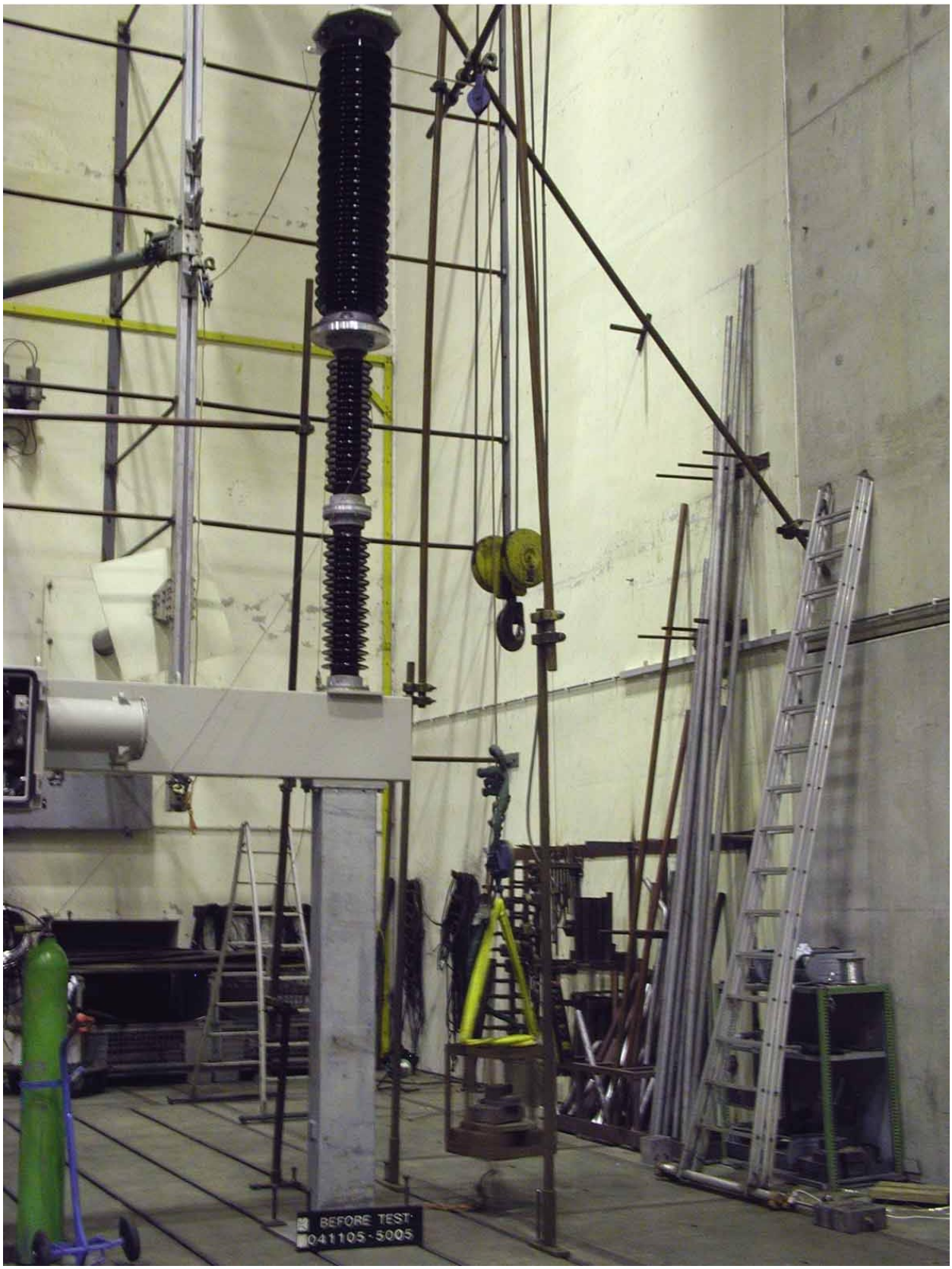
CONDITION BEFORE TESTS

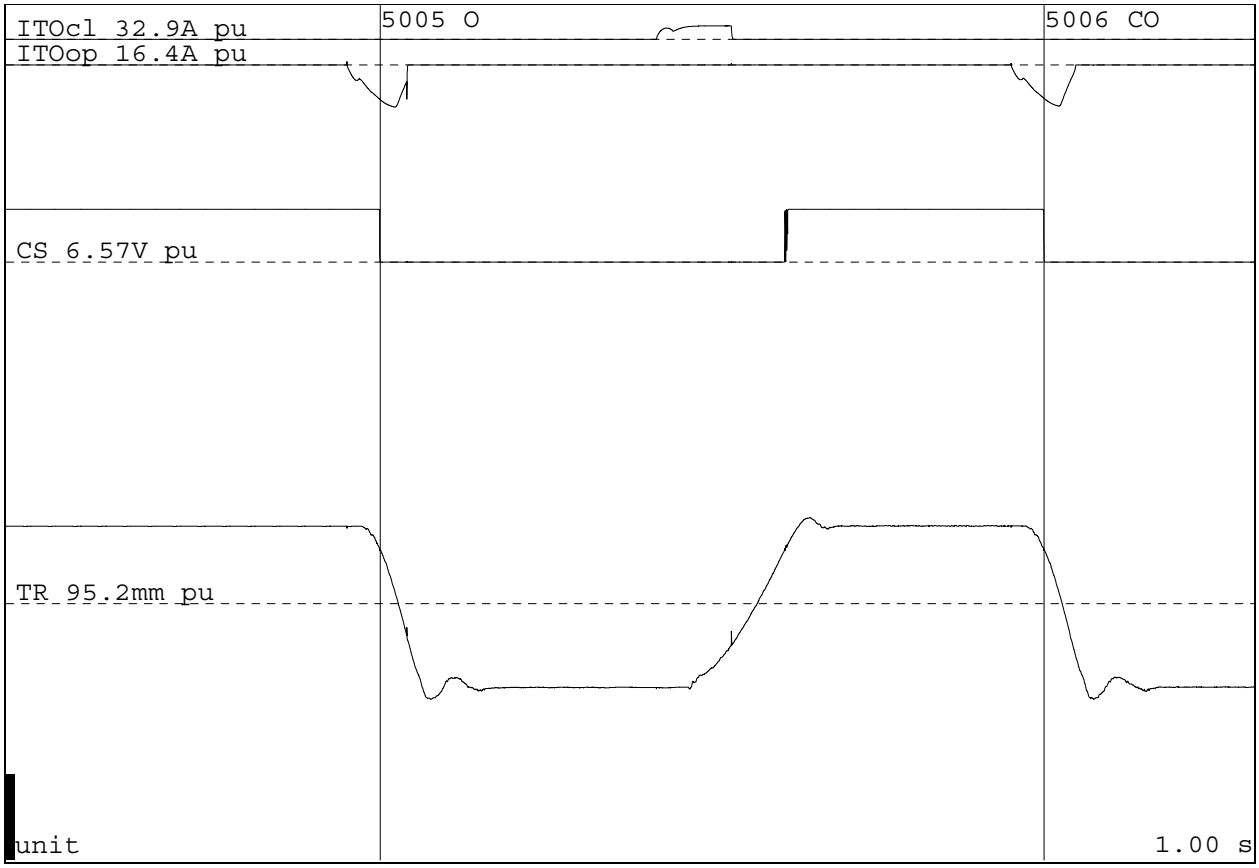
Breaker in same condition.

Tests 041105-5005 and 5006 : O – CO operation without static terminal load forces.
Tests 041105-5007 and 5008 : O – CO operation with the following static terminal load forces:
FthB = 750 N
Fwh = 560 N
Point of application: top of the terminal

TEST ARRANGEMENT




BEFORE TEST
041105-5005

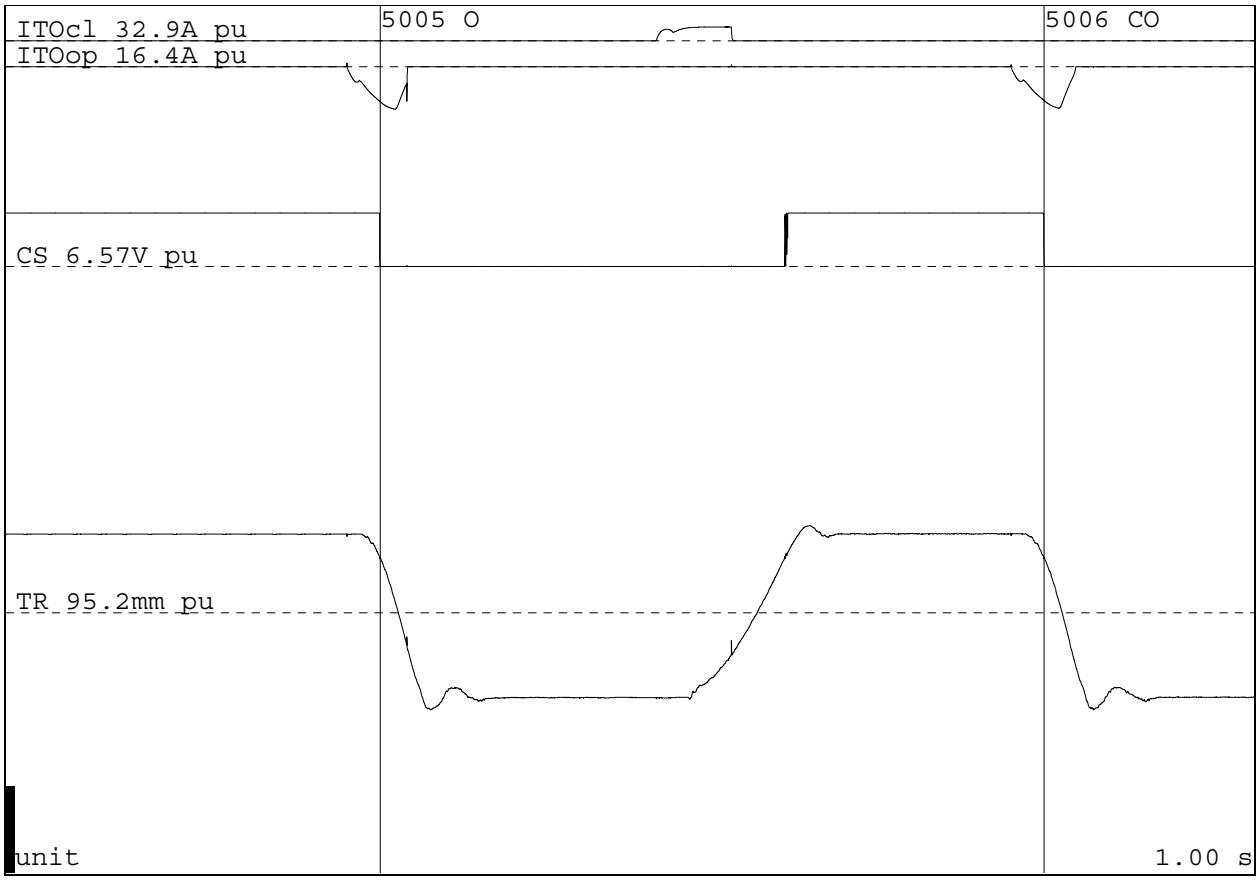


TEST NUMBER: 041105-5005

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,1

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

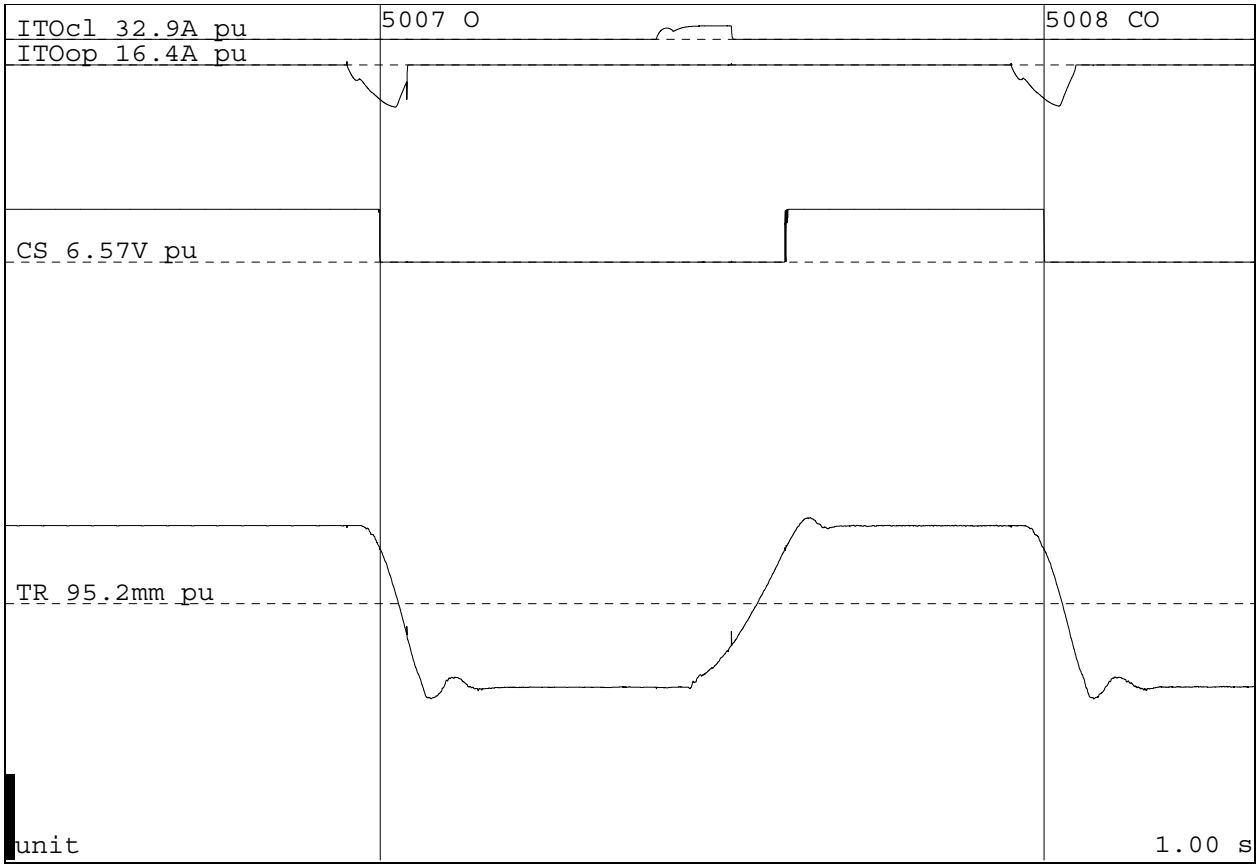


TEST NUMBER: 041105-5006

Time interval between operations	s	0,324
Operation		CO
Phase		**C**
Current closing coil	A	5,25
Closing time	ms	103
Current opening coil	A	7,90
Opening time	ms	25,1

Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

Remarks: -

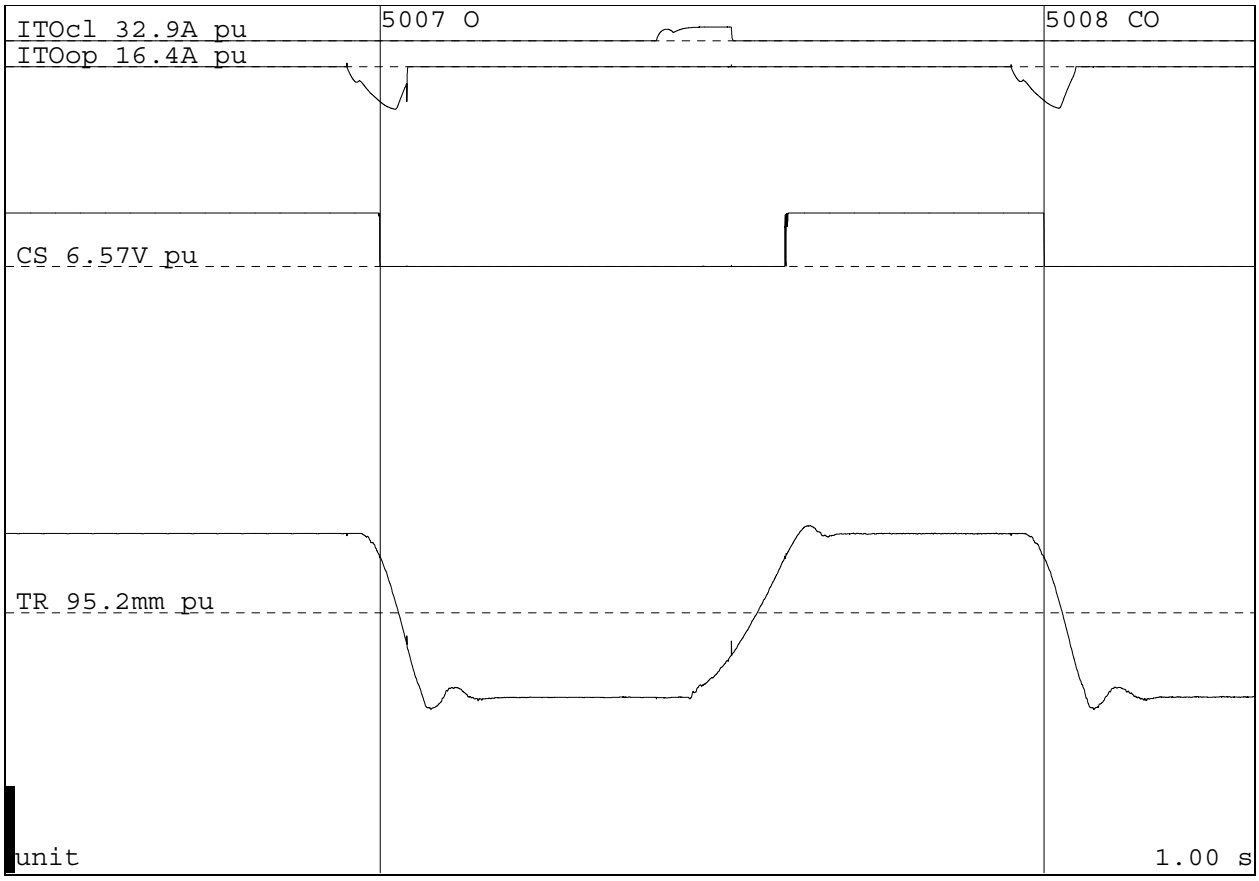


TEST NUMBER: 041105-5007

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,0

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

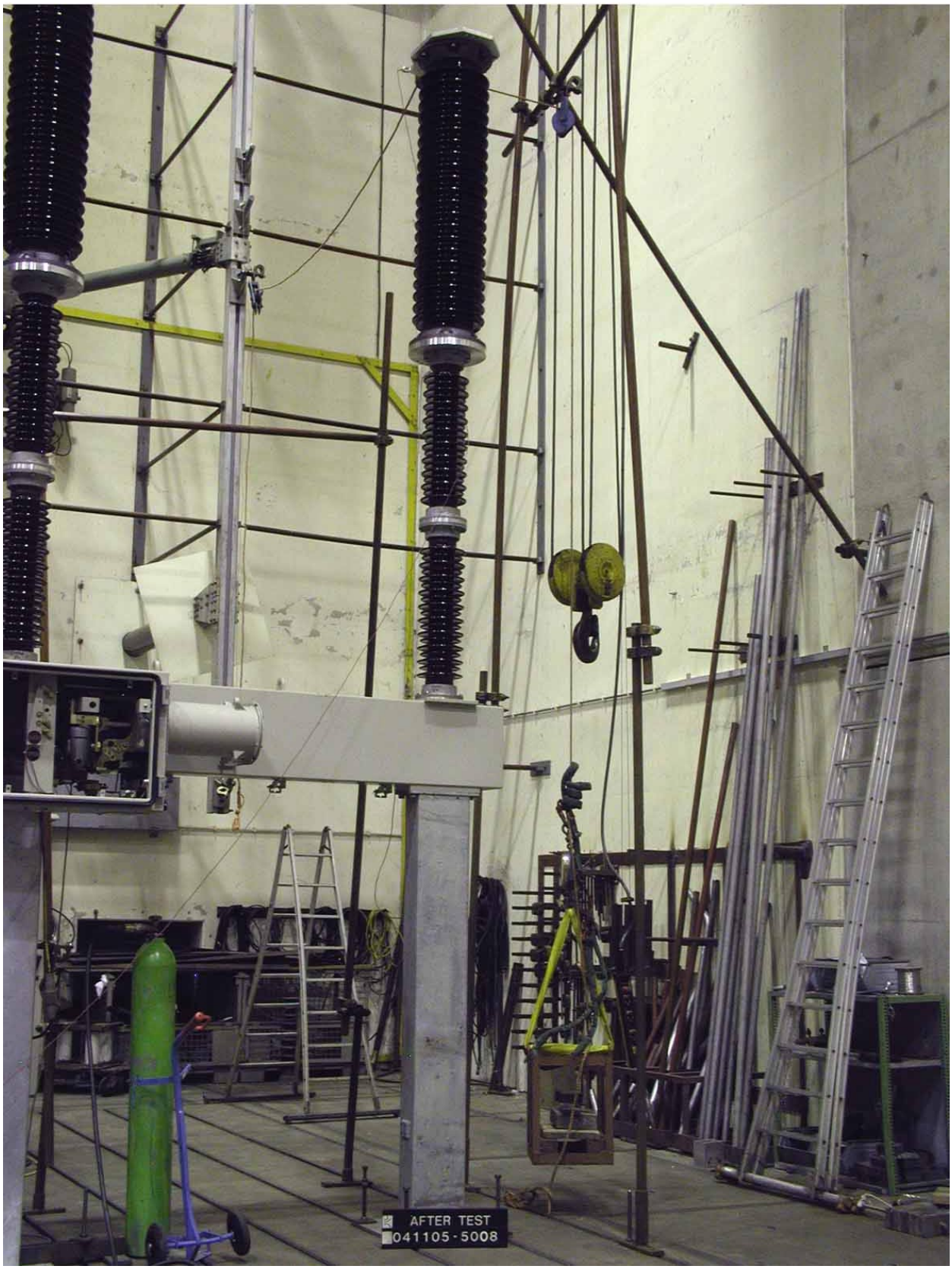


TEST NUMBER: 041105-5008

Time interval between operations	s	0,324
Operation		CO
Phase		**C**
Current closing coil	A	5,24
Closing time	ms	103
Current opening coil	A	7,90
Opening time	ms	25,7

Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

Remarks: -


AFTER TEST
041105-5008

TEST NUMBERS

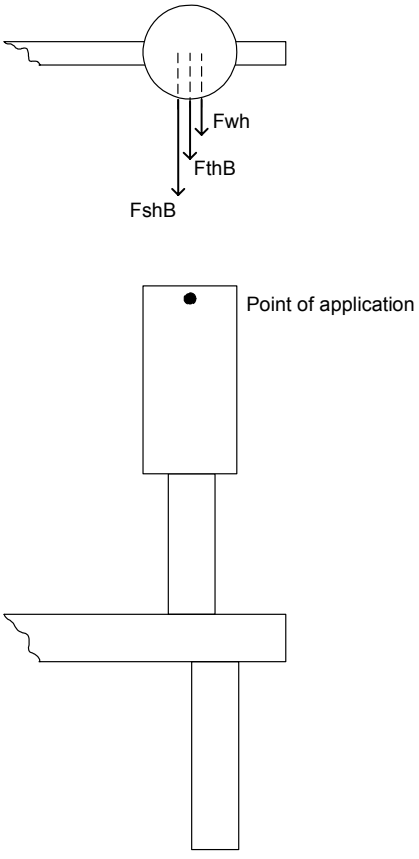
041105-5009
041105-5010
041105-5011
041105-5012

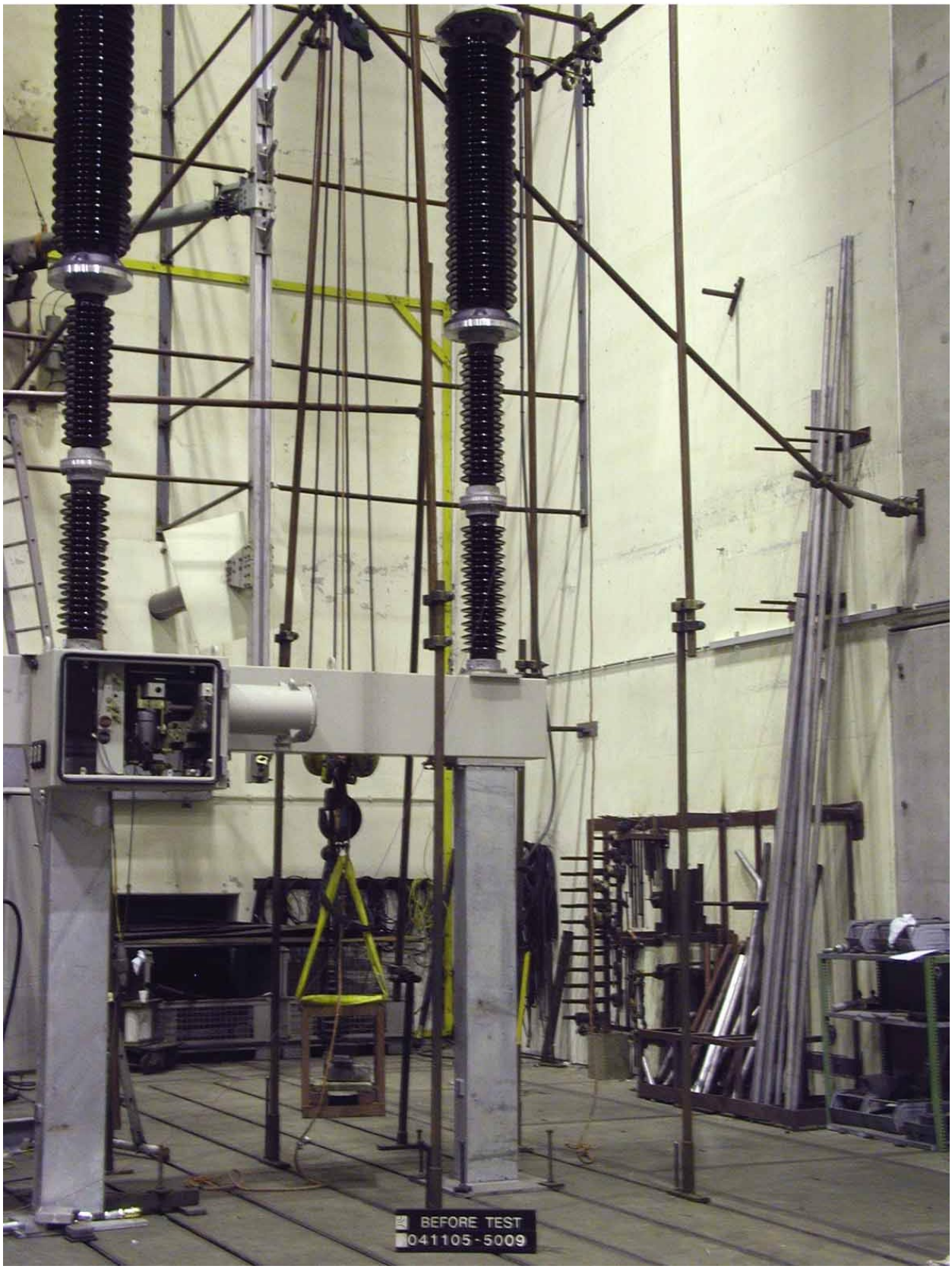
CONDITION BEFORE TESTS

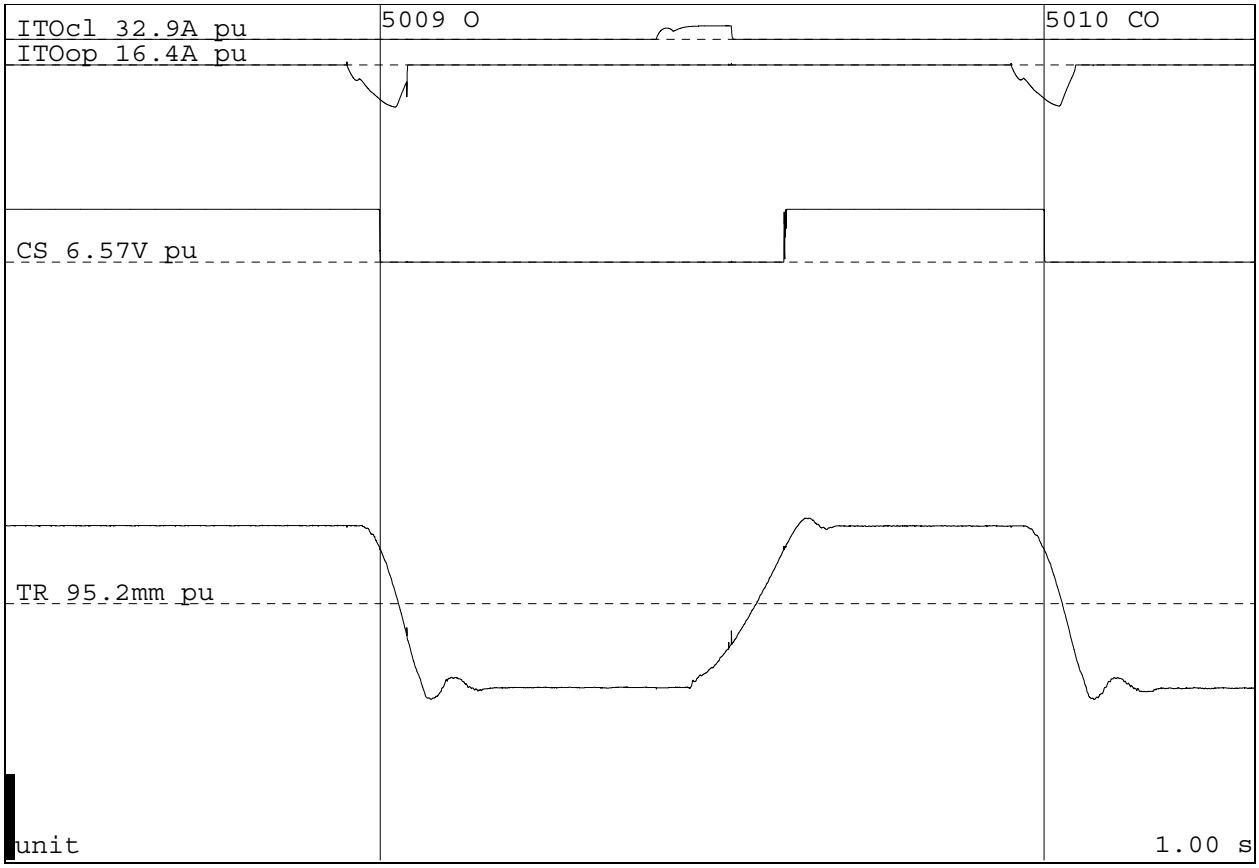
Breaker in same condition.

Tests 041105-5009 and 5010 : O – CO operation without static terminal load forces.
Tests 041105-5011 and 5012 : O – CO operation with the following static terminal load forces:
FthB = 750 N
Fwh = 560 N
Point of application: top of the terminal

TEST ARRANGEMENT




BEFORE TEST
041105-5009

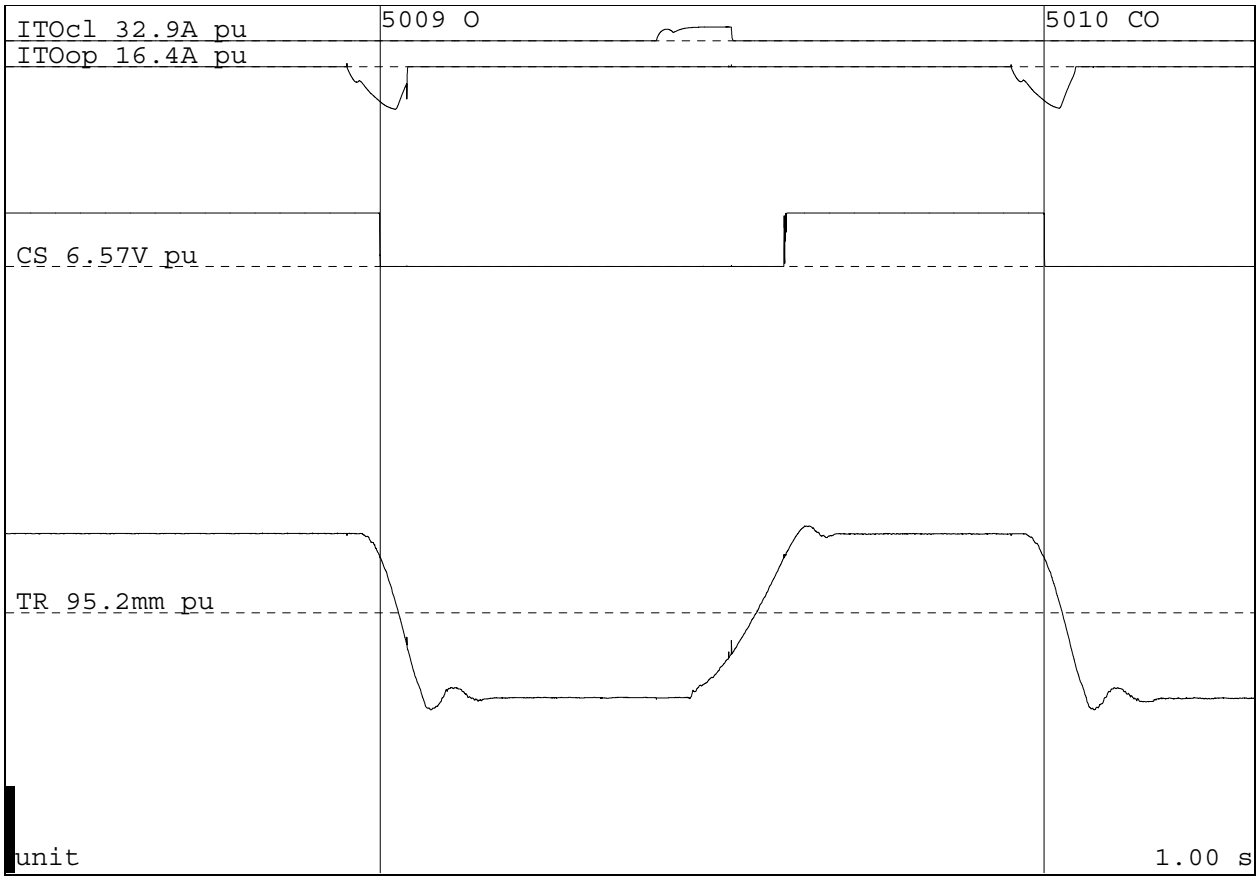


TEST NUMBER: 041105-5009

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,3

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

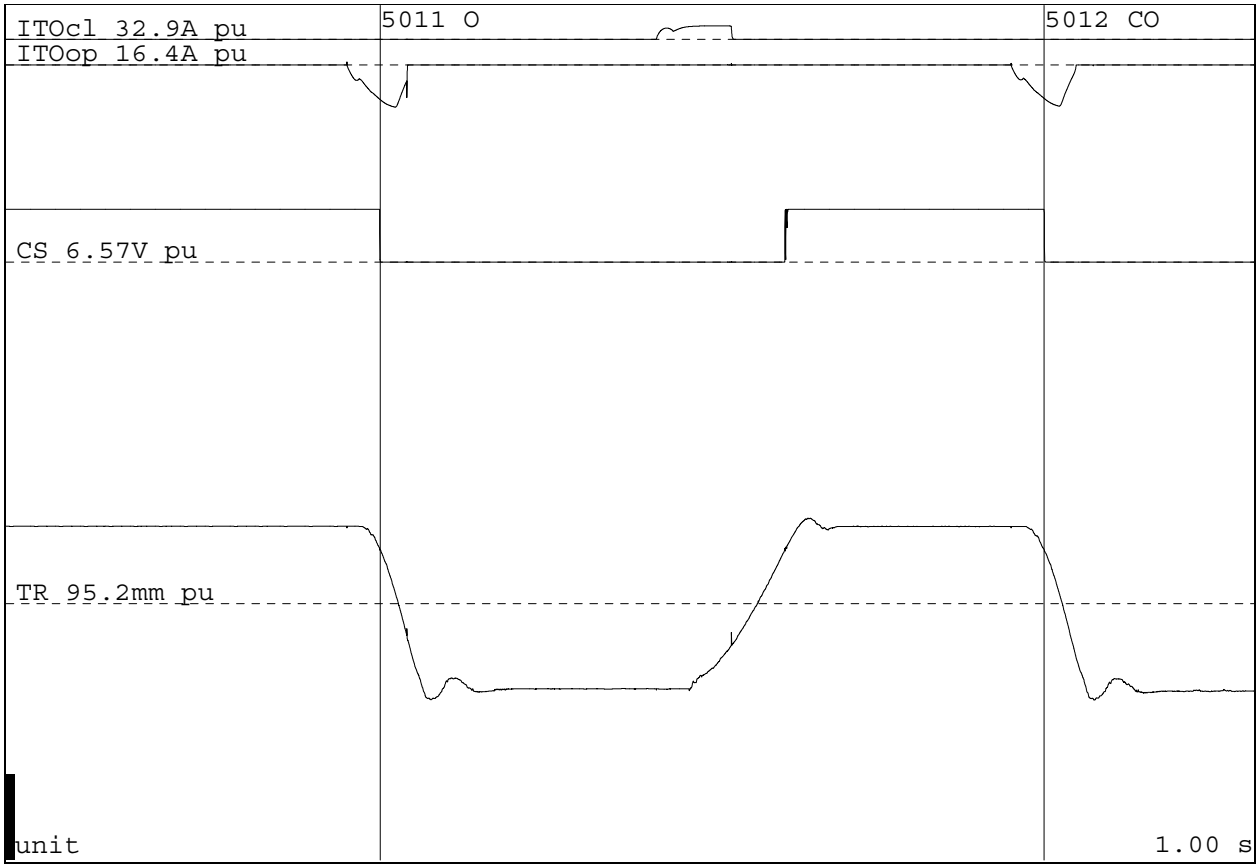


TEST NUMBER: 041105-5010

Time interval between operations	s	0,324
Operation		CO
Phase		**C**
Current closing coil	A	5,26
Closing time	ms	102
Current opening coil	A	7,90
Opening time	ms	26,0

Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

Remarks: -

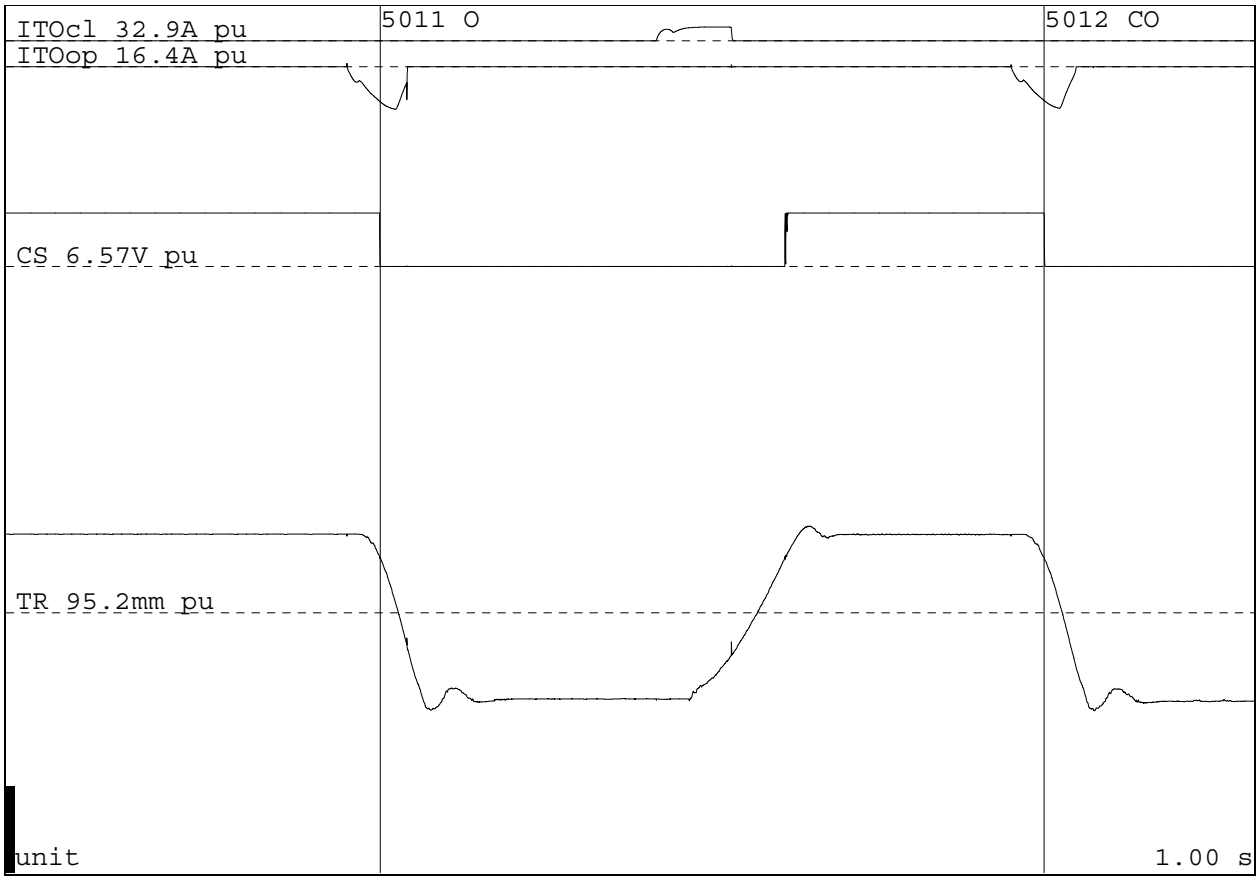


TEST NUMBER: 041105-5011

Operation		O
Phase		**C**
Current opening coil	A	8,10
Opening time	ms	25,5

Voltage opening coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
		Operating pressure	- MPa

Remarks: -

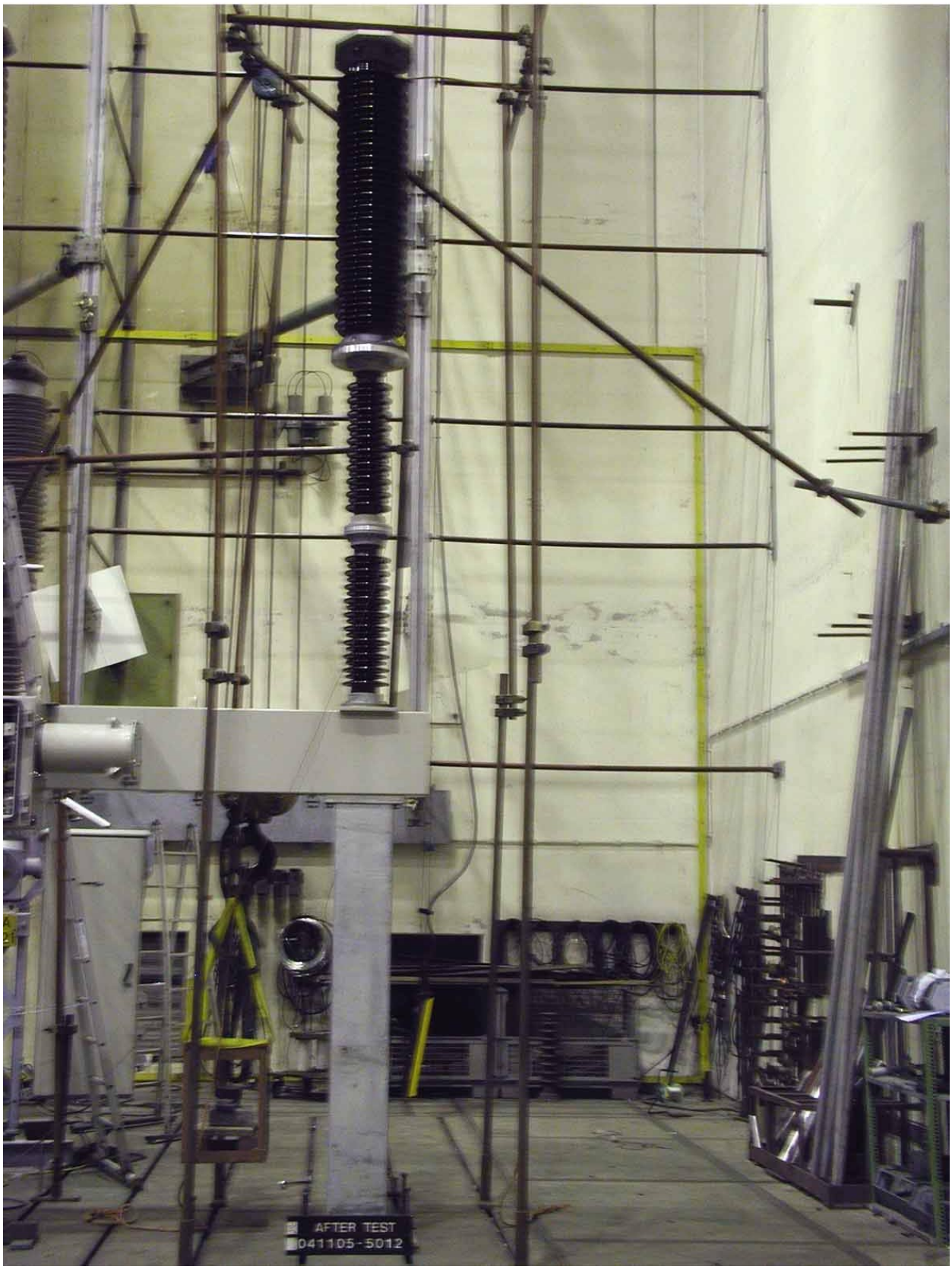


TEST NUMBER: 041105-5012

Time interval between operations	s	0,324
Operation		CO
Phase		**C**
Current closing coil	A	5,23
Closing time	ms	103
Current opening coil	A	7,90
Opening time	ms	25,8

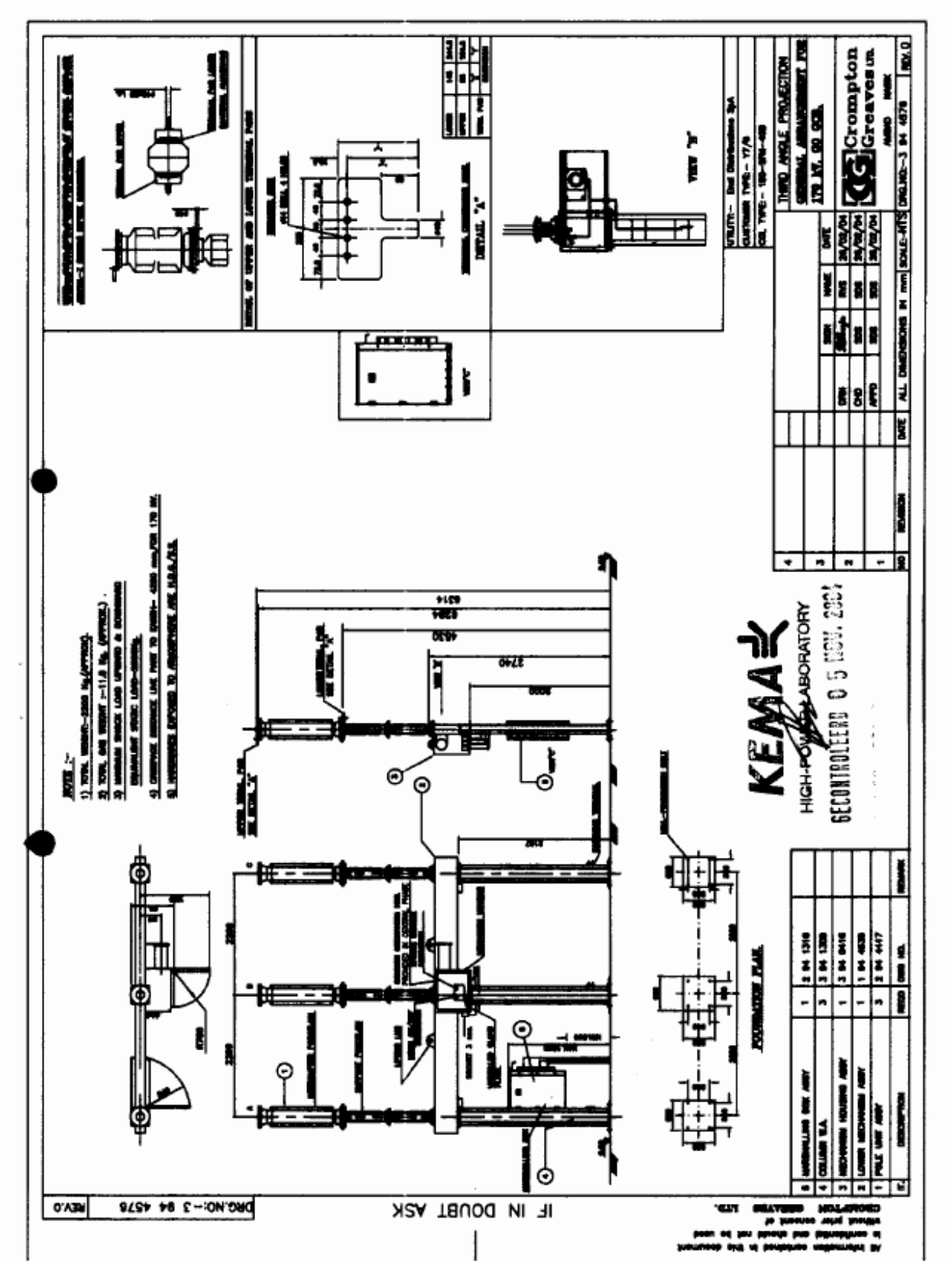
Voltage closing coil	110 Vd.c.	Gas pressure at 20 ºC	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

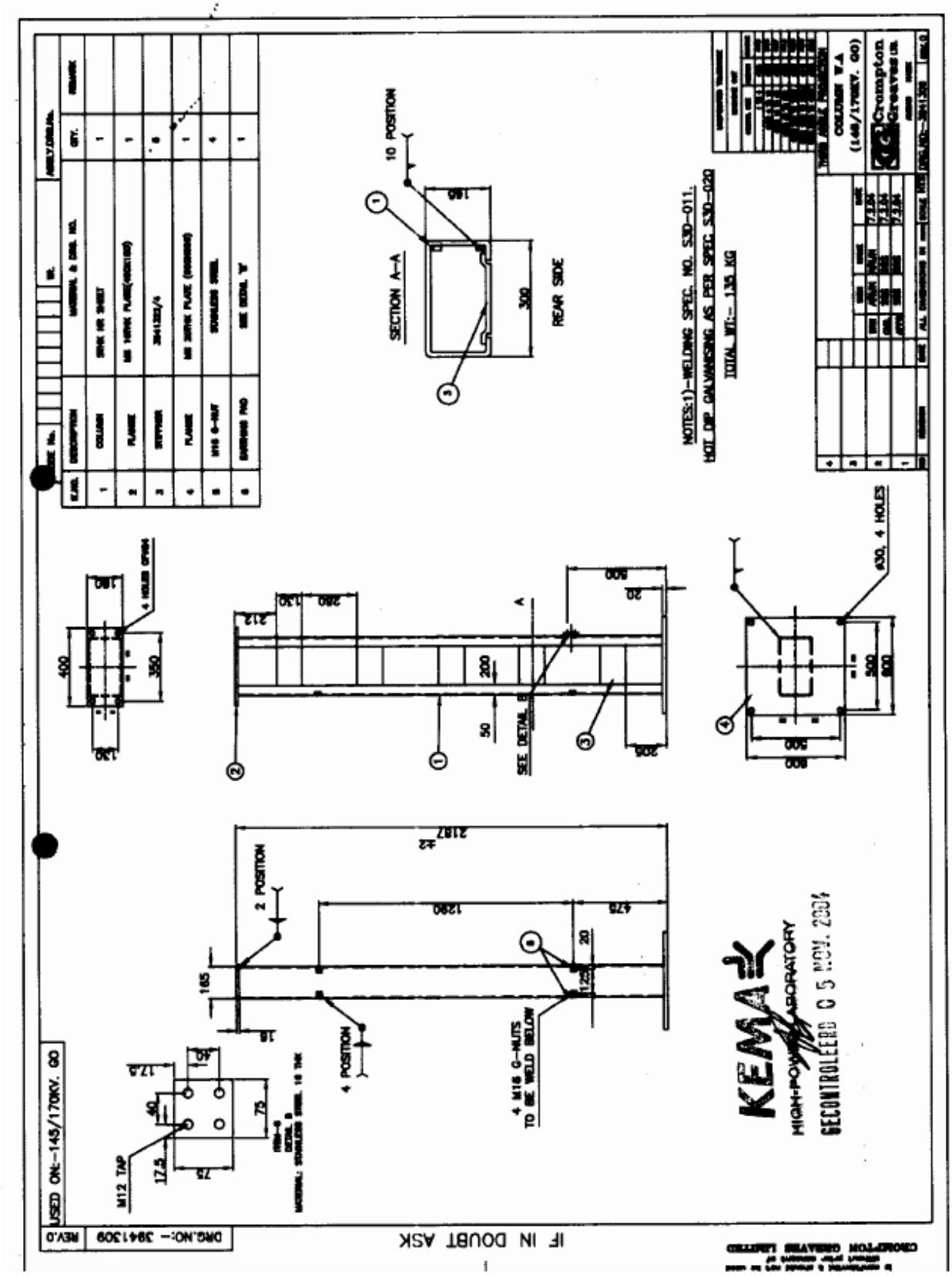
Remarks: -

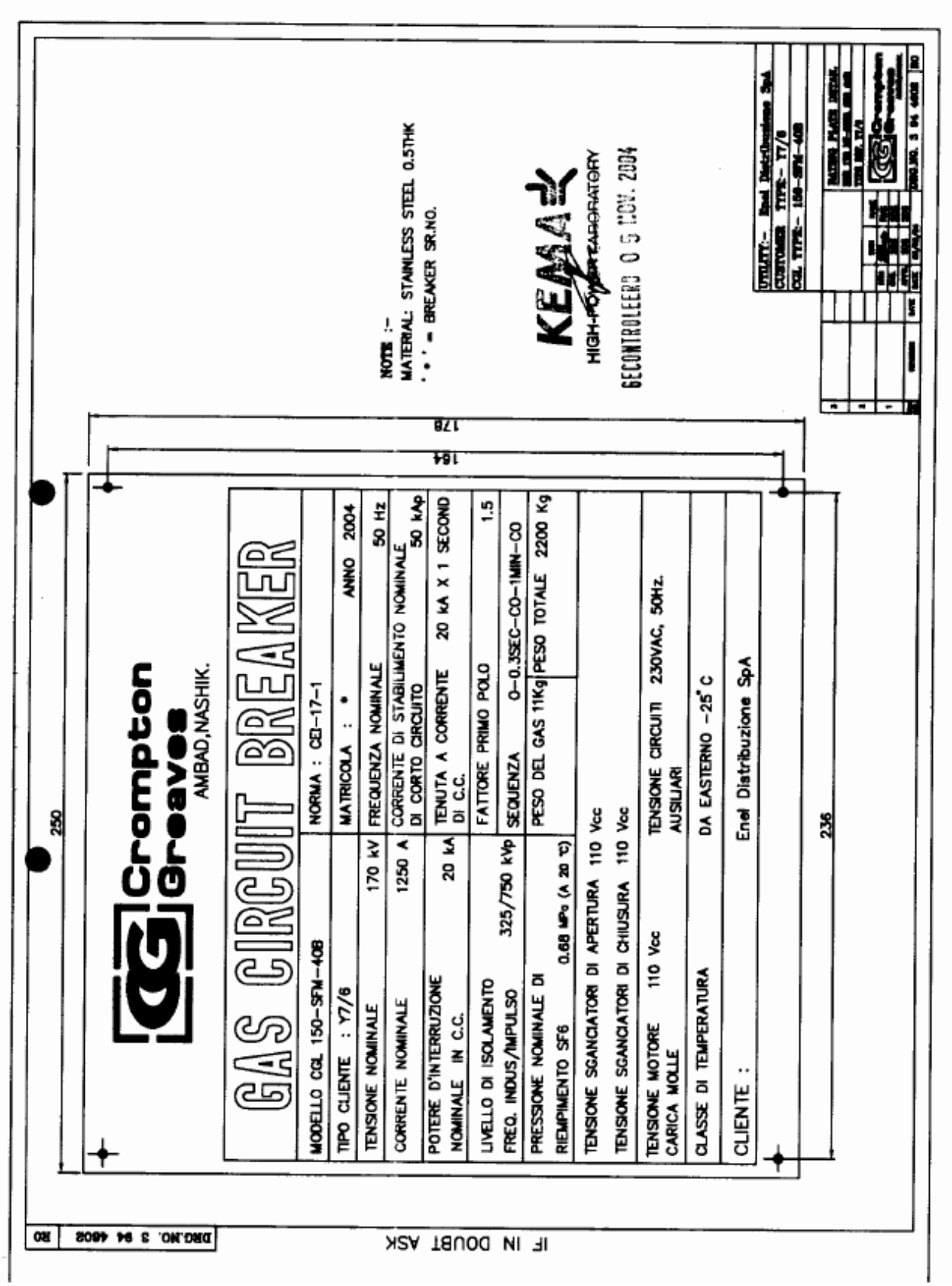

AFTER TEST
041105-5012

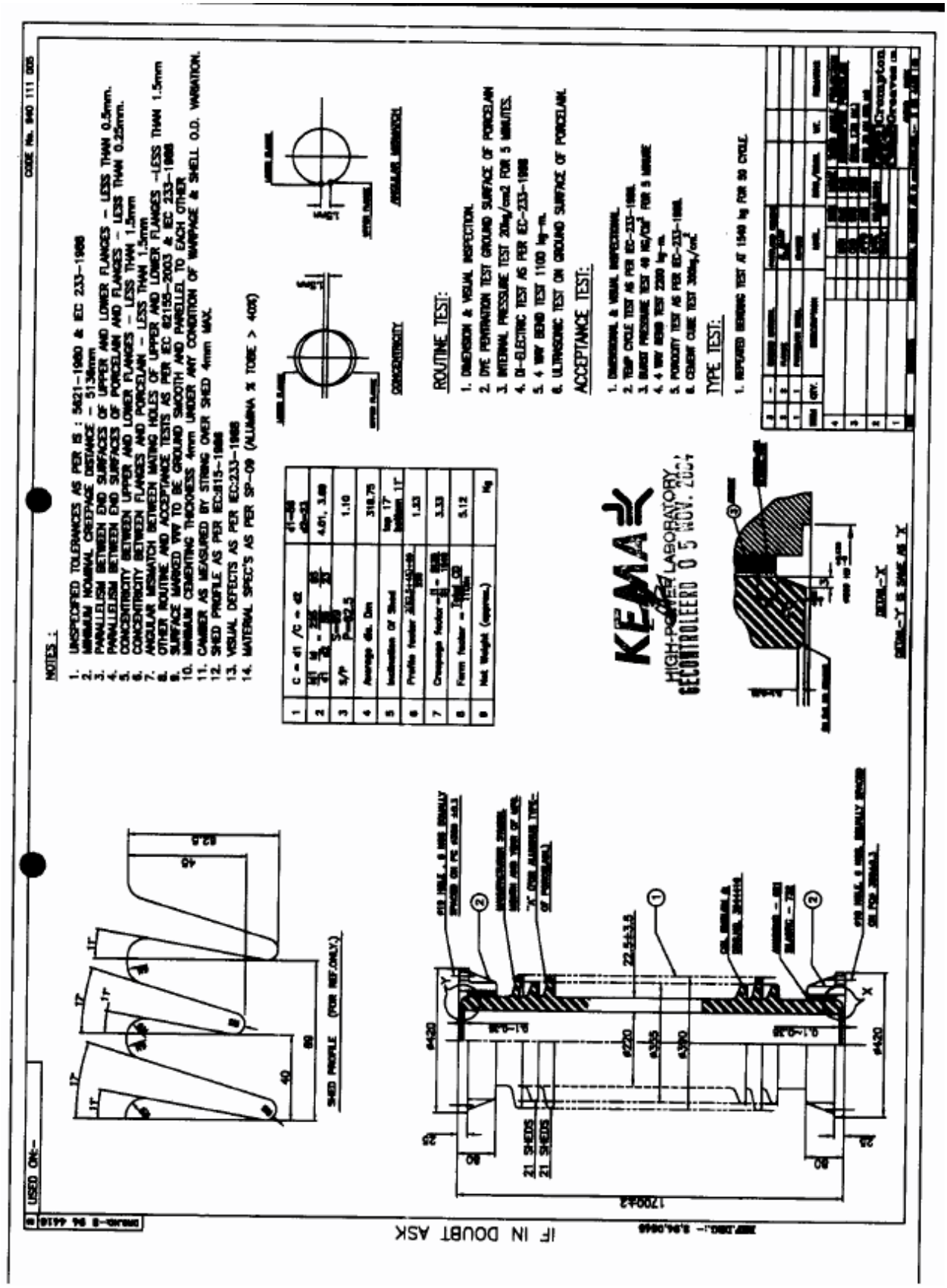
CONDITION / INSPECTION AFTER TEST

Breaker showed no visible change.

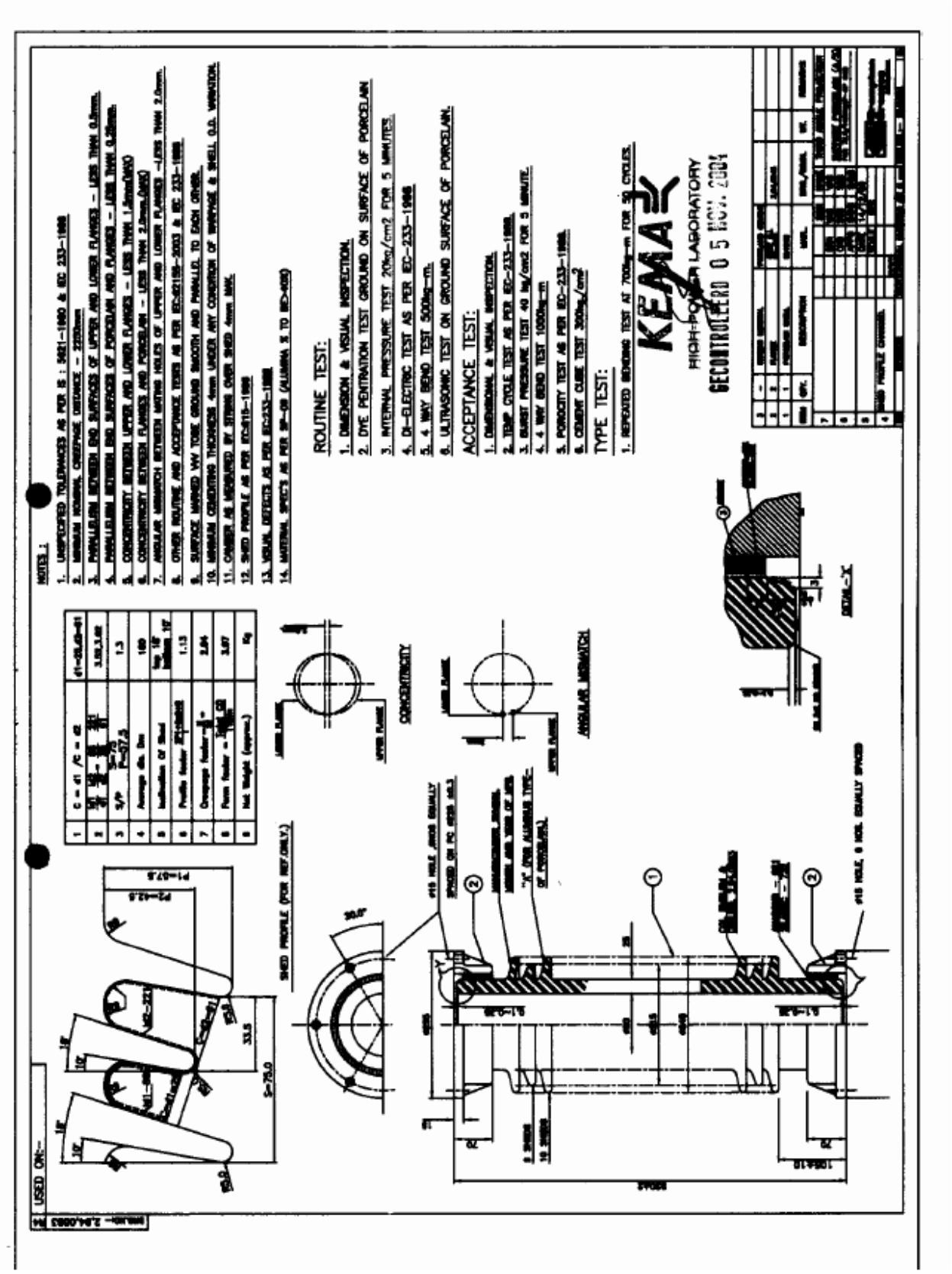

Crompton Greaves
THIRD ANGLE PROJECTION
ALL DIMENSIONS IN mm
IF IN DOUBT ASK
HIGH-POWER LABORATORY


10 POSITION
SECTION A-A
REAR SIDE
NOTES:1)-WELDING SPEC. NO. S3D-011.
HOT DIP GALVANISING AS PER SPEC. S3D-020
TOTAL WT:- 135 KG
4 HOLES ø30
2 POSITION
4 POSITION
4 M16 C-NUTS TO BE WELD BELOW
M12 TAP
USED ON:-145/170KV. GD
DRG.NO:- 3941309
REV.0
KEMA
HIGH-POWER LABORATORY
GECONTROLEERD 0 5 NOV. 2004
IF IN DOUBT ASK


GAS CIRCUIT BREAKER
Crompton Greaves
AMBAD,NASHIK.
MODELLO CGL 150-SFM-40B
NORMA : CEI-17-1
TIPO CLIENTE : Y7/6
MATRICOLA : *
ANNO 2004
TENSIONE NOMINALE 170 kV
FREQUENZA NOMINALE 50 Hz
CORRENTE NOMINALE 1250 A
CORRENTE DI STABILIMENTO NOMINALE 50 kAp
DI CORTO CIRCUITO
POTERE D'INTERRUZIONE NOMINALE IN C.C. 20 kA
TENUTA A CORRENTE 20 kA X 1 SECOND
DI C.C.
LIVELLO DI ISOLAMENTO 325/750 kVp
FREQ. INDUS/IMPULSO
FATTORE PRIMO POLO 1.5
SEQUENZA O-0.3SEC-CO-1MIN-CO
PRESSIONE NOMINALE DI RIEMPIMENTO SF6 0.68 MPa (A 20 °C)
PESO DEL GAS 11Kg
PESO TOTALE 2200 Kg
TENSIONE SGANCIATORI DI APERTURA 110 Vcc
TENSIONE SGANCIATORI DI CHIUSURA 110 Vcc
TENSIONE MOTORE CARICA MOLLE 110 Vcc
TENSIONE CIRCUITI AUSILIARI 230VAC, 50Hz.
CLASSE DI TEMPERATURA DA EASTERNO -25° C
CLIENTE : Enel Distribuzione SpA
NOTE :-
MATERIAL: STAINLESS STEEL 0.5THK
'*' - BREAKER SR.NO.
KEMA
HIGH-POWER LABORATORY
GECONTROLEERD 05 NOV. 2004
250
236
184
178
IF IN DOUBT ASK
DRG.NO. 3 94 4602
R0



DR


ROUTINE TEST:
ACCEPTANCE TEST:
TYPE TEST:
KEMA
HIGH-POWER LABORATORY
GECONTROLEERD 05 NOV. 2004

Sheet1

GUARANTEED TECHNICAL PARTICULARS FOR 170 KV, 20 KA, SF6, GCB.

(G/O)

CUSTOMER :- Enel Distribuzione SpA.

CGL REFERENCE :- 150-SFM-40B. **CUSTOMER REFERENCE :- Y7/6**

Sr. No.	Specification	Unit	Value
1	Rated System Voltage	KV(rms)	170
2	Rated Lightening Impulse Voltage	KV(peak)	750
3	Rated P. F. Withstand Voltage	KV	325
4	Rated Frequency	HZ	50
5	Rated Continuous Current	AMP(RMS)	1250
6	Rated Short Time withstand Current & Duration	KA(RMS) & SEC	20& 1
7	Rated Peak Withstand Current	KA(peak)	50
8	Rated Operating Sequence	-	O-0.3s-CO-1MIN-CO
9	Rated Line Charging Current	AMP(RMS)	63
10	Rated Cable Charging Current	AMP(RMS)	160
11	Rated Single Capacitor Bank Current	AMP(RMS)	315
12	Rated Out of Phase Current	AMP(RMS)	5
13	Rated Breaking Time	MILLISECS	60
14	Rated Closing Time	MILLISECS	150
15	Rated Auxiliary Supply Voltage --		
	Control Circuit	VOLTS(DC)	110
	Motor	VOLTS(DC)	110
16	Rated Power Consumption of Closing & Tripping		
	Circuits -- D. C. Circuit-CLOSE, TR1, TR2	WATTS	<1500
	-- A. C. Circuit/Motor Circuit	VA	<2500

KEMA
HIGH-POWER LABORATORY
GECONTROLEERD 0 5 NOV. 2001

DR

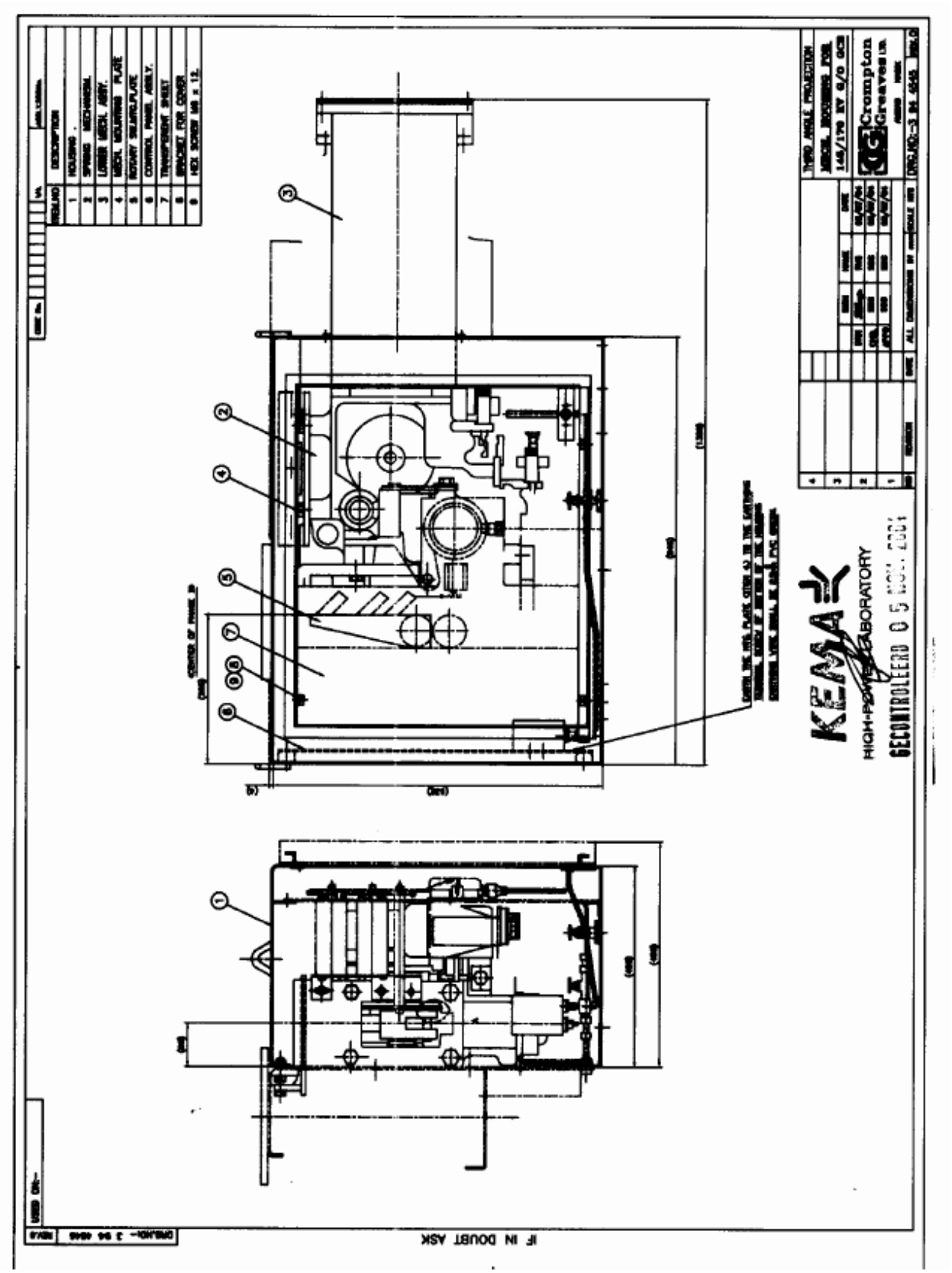
DRGS. FOR ENEL 170kV.GO GCB.

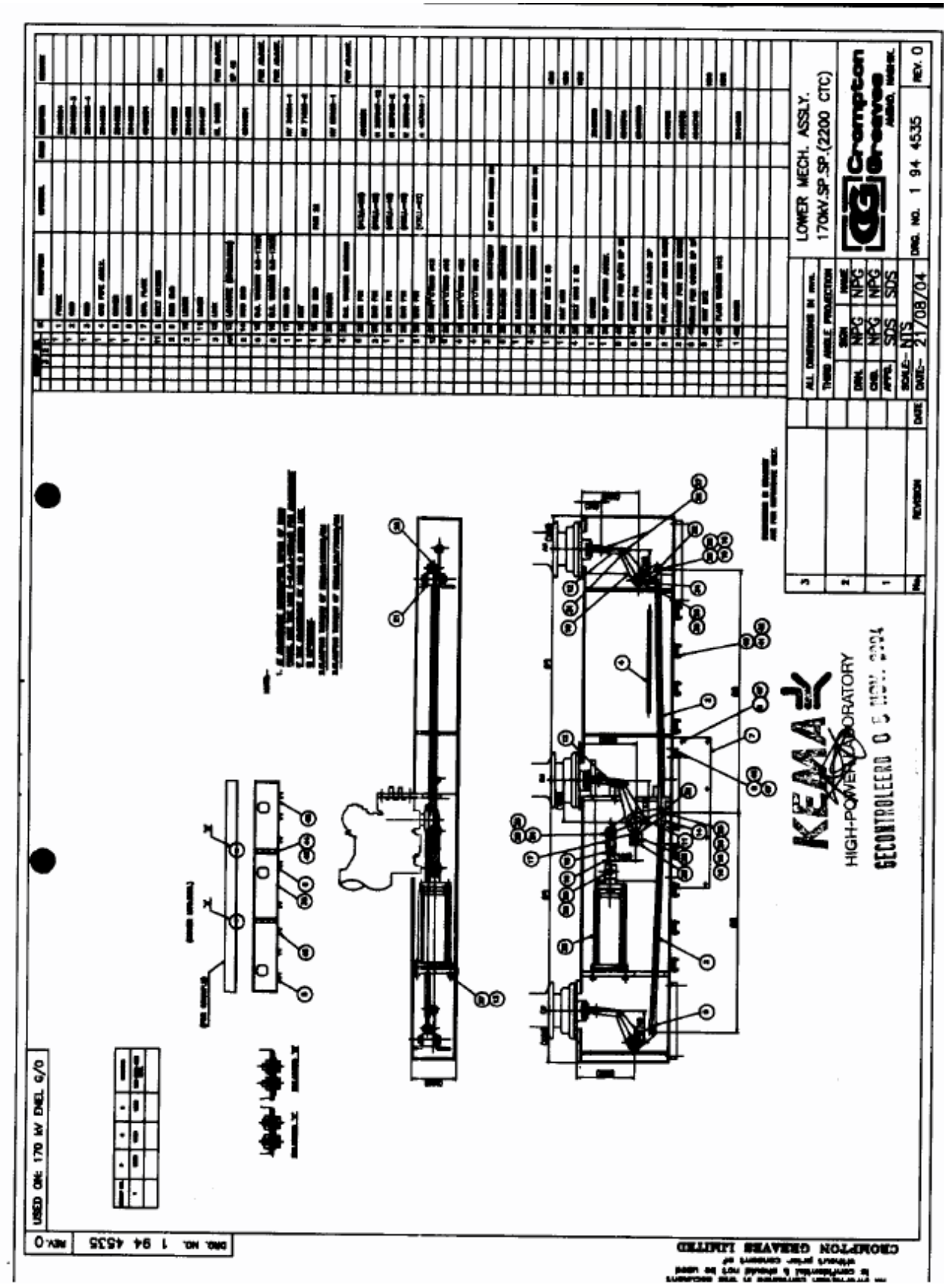
TYPE-B

Sr.No.	DESCRIPTION	DRG.No.	REV.No.
1	Pole unit assly.	2 94 4417	0
2	Interrupter assy.	2 94 4499	0
3	Stationary contact assly.	3 94 4483	0
4	Moving contact assly.	3 94 4500	0
5	Operating rod assy.	3 94 4501	0
6	Stationary contact	3 94 4171	0
7	Stationary arc contact	3 94 0630	0
8	Upper Terminal	3 94 4473	0
9	Joint	HL 69774	1
10	Moving contact	4 94 4176	0
11	Fixed finger contact	3 94 4177	0
12	Moving arc contact	3 94 0631	0
13	Nozzle	3 94 4346	0
14	Puffeer cylinder	3 94 4428	0
15	Interrupter porcelain	3 94 4416	0
16	Support porcelain	2 94 0583	4
17	Insulating rod	HW 52358 G12	2
18	Mechanism housing.	3 94 0416	0
19	Lower Mechanism Assly.	1 94 4535	0
20	Type B M spring operating mechanism	HK 88705	3
21	Trip Mech. assy.	HK 88094	1
22	Closing Mech. assy.	HK 88092	1
23	Spring charging Mech. assy.	HK 88090	6
24	Motor assy.	H2A 5316	0
25	Trip spring assy.	H2C 9027	1
26	Closing spring assy.	HL 58085	1
27	Shock absorber assy.	HL 94233	1
28	Cam Shaft assy.	HK 88091	0
29	Ratchet wheel	HR 86364	1
30	Small pawl	HP 97885	3
31	Large pawl	HV 53930	3
32	Closing spring	4 94 4045	4
33	Tripping spring	4 94 4005	3
34	Closing spring rod	3 94 0484	1
35	Three phase lever	3 94 4457	0
36	Two phase lever	3 94 4458	0
37	Connecting rod(suit for 2200mm ph.center)	3 94 1093	5
38	Closing coil Ref-G1 for 110 V DC	HJ 79291	7
39	Tripping coil Ref-1 for 110 V DC	4 94 0011	7
40	Rotary SW mtg drg.	3 94 4636	0
41	Base frame details	3 94 4658	0
42	Marshalling Box assembly	2 94 1310	0
43	Coloumn w.a.	3 94 1309	0

VEIKI-VNL Electric Large Laboratories Ltd.
Certification Office
H-1158 Budapest, Vasvirág u. 2-4.
03. 09. 2004

KEMA
HIGH-POWER LABORATORY
GECONTROLEERD 04 NOV. 2004


KEMA
HIGH-POWER LABORATORY
GECONTROLEERD
Crompton Greaves


LOWER MECH. ASSLY.
170kV.SP.SP.(2200 CTC)
Crompton Greaves
DRG. NO. 1 94 4535
REV. 0
DATE 21/08/04
USED ON: 170 kV DEL C/O
DRG. NO. 1 94 4535
REV. 0
CROMPTON GREAVES LIMITED
KEMA
HIGH-POWER LABORATORY
GECONTROLEERD